# CUSTOMS SYSTEM AND USING ADVANCED TECHNOLOGIES IN CUSTOMS

A Master's Thesis submitted for the degree of
"Master of Science"

supervised by
Prof. Dr.techn. Prof.h.c. Dr.h.c. Numan M. Durakbasa

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Vienna, 08.04.2020

# Affidavit

I, **FAKHRI AZIZ OGLU MAMMADOV**, hereby declare

1. that I am the sole author of the present Master's Thesis, "CUSTOMS SYSTEM AND USING ADVANCED TECHNOLOGIES IN CUSTOMS", 83 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and

2. that I have not prior to this date submitted the topic of this Master's Thesis or parts of it in any form for assessment as an examination paper, either in Austria or abroad.


Vienna, 08.04.2020                                                    _____

                                                                                    Signature

# ABSTRACT

In many countries, Customs authorities are one of the key state institutions. They commonly regulate foreign trade and conducts of state economy policy through tariff and nontariff methods, perform revenue collection, combat against smuggling. The other activities performed by Customs are protection health and safety of society, export control in respect of dual use items (software, commodities and technologies), protection Intellectual Property rights. They are always on frontline of border in order to perform customs control of travellers, cargo containers, means of transport. Customs acknowledges trade facilitation and simplification of processes and regulations. Today Customs change mentality and focused to be more Service Oriented. It is done in order to bring cash to state account through trade facilitation, simplification of processes and fast revenue collection from economic operators. Such mechanisms support boosting economy. Thus, developing SMART Customs Concept (or Customs 4.0) is priority. Consider key role of Customs in trade facilitation and compliance, revenue collection in this paper prime focus done on Organization of Customs through framework of World Customs Organization (WCO) and Azerbaijan's Customs. From this perspective discussed key role and importance of WCO and Azerbaijan Customs, reviewed vision, mission, goals and values, structure and activities, legislation, latest achievements and solutions in Digital Customs and ways in preventing of smuggling. Another area of research was Industry 4.0, advanced technologies used by Customs and how these technologies impact on customs activities. From this perspective discussed what is Industry 4.0 and how it connected to Customs 4.0, researched and reviewed disruptive technologies that being used by Customs such as: 1) Internet of Things (IoT); 2) Blockchain; 3) Artificial Intelligence (AI); 4) Machine Learning (ML); 5) Big Data and Analytics; 6) Virtual, Augmented and Mixed Reality; 7) Biometrics (Facial recognition), 8) Robots (Customs Robots); 9) Drones; 10) Video surveillance technology. Also considered additional areas of application in Customs for listed above emerging technologies, latest trends in digitalisation, automation of customs processes (Electronic Data Interchange, Single Window, International Customs Transit and Guarantee System (eTIR Digital System), Automated System for Customs Data, Global Travel Assessment System, Advanced Passenger Information and Passenger Name Record. Broadly researched different types of latest Non-Intrusive Inspection (NII) and detection technologies based on X-ray Images (Computed Tomography 3D) or gamma ray, and NII related latest developments (Unified X-ray File Format) and projects (C-BORD-Effective Container Inspection at BORDer Control Points). Various subject related situational examples integrated into this paper. Author proposed seven recommendations to Customs which believes add value in prospect.

**PREFACE**

This master thesis is written for the degree of Master of Science in Engineering Management offered by Engineering School of the Vienna University of Technology (Technische Universität Wien) Continuing Education Center. Considering global trend to digitalization in all areas of global travel, trade and supply chain industry, this master thesis focused on relations and impact of Industry 4.0 and cutting technologies (Industrial Internet of Things (IIoT), Artificial Intelligence (AI), Blockchain technology, Autonomous Robots and Drones, Big Data and Analytics) in Customs activities, power and potential impact these technologies on trade facilitation, regulations compliance and border security. Customs administrations across the globe have different resource capacities. However, undoubtedly that Customs must adopt and implement available capabilities of Industry 4.0 more broadly, including adaptation for daily operations in order to support successful policymaking, boosting global trade and prevent illegal activities of criminal groups. Customs operates in frontline of border and communicate, cooperate with economic operators. That is why key for Customs to have great awareness and match to latest atmosphere of innovating and rapidly developing digital trade. From this point of view World Customs Organization (WCO) performs great job. WCO works on research and development and helps to National Customs Administrations as well as Private Sector with technical assistance, recommendations, guides and legal tools.

The purpose of this master thesis bringing additional value and increase academic resources for Customs Officers with focus on Industry 4.0 and latest disruptive technologies. This master thesis will benefit also for academia, students, other professionals from trade, supply chain industry and private sectors.

The uniqueness of this master thesis is novelty and practicable application of presented data that included in single academic research paper. There is limited publications and lack of special books related to disruptive technologies used by Customs and impact such technologies to Customs Business. Despite of these, the author used analysis and empirical methods of research, and reviewed key Customs Revised Kyoto Convention (entered into force 2006), UN TIR Convention (1975) with focus on Information and Communication Technology, latest data from number of reputable international sources on the subject matter, reports, magazine publications of WCO, EU Taxation and Customs, World Economic Forum, United Nations.

The present research was completed under the supervision of Prof. Dr.techn. Prof.h.c. Dr.h.c. Numan M. Durakbasa, Head of Department for Faculty of Mechanical and Industrial Engineering of the Institute of Production Engineering and Laser Technology at the Vienna University of Technology.

To the best of my knowledge this completed work is unique, with exemptions on references and acknowledgements are made for other sources and previous works.

Fakhri Aziz oglu Mammadov (PhD), March 2020, Vienna

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Figure 1: Belgium established digital customs system – BE-GATE facilitates e-commerce (Port of Antwerp). Source www.freightcomms.com.

# 1. INTRODUCTION

Customs authorities are one of the key institutions which regulates foreign trade and conducts of state economy policy through tariff and nontariff methods. They collect of customs duties and taxes, supports of developing national sovereign economy through trade facilitation measures, monetary control and export/import control in respect of commodities, software and technology. Customs has an increasing responsibility in the economic and trade domain both on domestic and international level. However, Customs administrations conduct not only protection of economic interests of state and trade regulation, but also actively involved in the law enforcement activities. These law enforcement activities are fight against: 1) smuggling of goods; 2) transnational organized crime; 3) illicit trafficking of human beings, 4) illegal drug trafficking, 5) illegal trafficking psychotropic substances, precursors and rendering assistance to drug and psychotropic substance addicts, 6) illegal trafficking weapons of mass destruction and their means of delivery, 7) counterterrorism. In the area of export control, they perform monitoring and controlling of military items and dual-use items. Also, Customs administrations performs activities that aimed to protect intellectual property (IP) rights, counterfeiting and piracy, health and safety. In many countries Customs is one of the fundamental organizations and stakeholders, participating in global trade circle and ensuring supply chain security. As stated in the report on the European Union customs enforcement of intellectual

property (IP) rights, for example China is the general key state of origin for goods suspected of breaching one or more intellectual property rights delivering in the European Union. As per Report on the EU Customs enforcement of Intellectual Property Rights for particular product categories, other countries trait as the major states of origin, substantially are: "*1) North Macedonia for alcoholic beverages; 2) Turkey for other beverages and perfumes and cosmetics; 3) Hong Kong, China for watches, cellular phones and accessories, ink cartridges and toners, CDs/DVDs and labels, tags and stickers; 4) India for IT (computer) equipment; 5) Cambodia for tobacco (cigarettes); 6) Bosnia and Herzegovina for packaging material*"[1]. Another interest fact from above report in respect of health and safety concerns products for everyday use and products that would be really danger to the health and safety of users. For instance, *"suspected trademark breach relatively food and beverages, body care items, medicines, electrical household goods and playthings accounted for 36.8 % (a decrease compared to 2017 but comparable to the 34.2 % in 2016) of the total amount of detained items*"[2] by Customs. Nowadays Customs administrations conduct governance, legal regulation, develop and implement the best international practices, standards for compliance and trade facilitation, customs valuation and rules of origin. They have strong collaboration and cooperation between customs and economic operators. Customs produces statistics and reports, recommendations to local and global trade participants, training and learning, harmonised customs solutions for trade, E-customs and other services based on information technology, using applications and emerging technologies which are essential part of Industry 4.0. Today Customs organizations are applying on technological innovations and creativity in order to be in trend with digital transformation. Using cutting edge technologies such as blockchain technology, internet of things (IoT), Industrial Internet of Things (IIoT), artificial intelligence (AI), machine learning (ML), cloud computing, biometrics, unmanned aerial vehicles (UAV) in Customs operations are decisive for not "losing the face" in fight against swindle, unlawful and any criminal activities. Already found a general understanding of the framework of emerging technologies in the Customs environment. Artificial intelligence presents an extremely chance in risk management and in finding real trade lines. Drones are unmanned aerial vehicle operated by distance control being used already by some National Customs administrations (for example in the United States of America and United Arab Emirates) for observation and control tasks. In the meanwhile, as noted in World Customs Organization study report on Disruptive Technologies Customs authorities can likely use drones for surveillance in unachievable and hazardous territories, closing the breaks, if there is one in frontier

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[1] European Commission, Taxation and Customs Union: Results at the EU Border, 2018. In: *Report on the EU Customs enforcement of Intellectual Property Rights*. Luxembourg: Publications Office of the European Union, 2019.
[2] Ibid.

surveillance in those fields. Equipped with infrared and high-resolution imaging, drones may be efficient in border and naval surveillance, in specific for monitoring and controlling suspects, curbing cross-border contraband and narcotic trafficking, and nuclear, biological and chemical detecting and tracing. In future drones can be used for cross-border delivery of legal goods more widely, after setup of necessary customs regulatory issues. At present, Customs in face with emerging real challenges as organised criminal groups have already used drones for their illegal activities. For example, as reported in study report on Disruptive Technologies released by WCO "*in 2015, 28 pounds of heroin were found to have been illegally moved across the frontier into the U.S. using drones*"[3]. China is the one of the major producers of civil drones for consumers in global scale. Thus, regulating drones are becoming crucial for Chinese government and their Customs body, because drones uses by criminal groups in Asia region for delivering for instance smartphones from Hong Kong to Shenzhen. As another example, Customs officers in southern China's technology hub Shenzhen disclosed an illegal activity of criminal group who using drones smuggled cellular phones in value equal of USD 79.8 million.



Picture 1: The photo shows drones and wires captured by the Shenzhen Customs for above case. Source www.chinadailyhk.com.

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[3] World Customs Organization (WCO): Study report on Disruptive Technologies, June 2019. Publisher World Customs Organization, Belgium.

As reported in News article of ChinaDaily, approximately 10,000 to 15,000 cellular phones could be contrabanded in one day using drones as delivery method. The offence was able to discover as results of joint efforts of law enforcement officers from both parties routed the operation in February 2018, after several months of investigation. In this case, the band had reported that operating since 2016[4].

The described cases are a serious call, and Customs authorities must understand the importance of stopping contraband activities leaded with the use of drones. It is obviously, that with progressive technological achievements and raising preciosity, drones could soon be used for cross-border supplies of commodities. Customs is the government structure that responsible for cross-border movement of the vehicles which included unmanned drones as well. The existing of some other regulatory concerns in respect of the use of drones for cross-border delivery of legal goods as part of e-commerce order and delivery to purchasers directly, instead of airport-to-airport services, and customs control of cross-border movement of unmanned drones (current regulations are established for means of transport with drivers or pilots only), must be further investigated in line with acting regulations, and in agreement with civil aviation, other appropriate state bodies and business organisations.

Continuing consider relations of Industry 4.0 to Customs, it is important to list nine key elements of Industry 4.0 and they are: 1) autonomous robots, 2) additive manufacturing (3D printing), 3) augmented reality, 4) big data and analytics, 5) the cloud, 6) cyber-physical systems (CPS), 7) the industrial internet of things (IoT), 8) horizontal and vertical system integration, 9) simulation.

3D printing is one of the hot topics that raised by Customs Officials. Despite of the useless of 3D printing by Customs itself today, it is important to predict the possible future application of 3D printing in Customs operations. Customs have concern about increasing number of economic operators that holders of 3D printers. In some countries, importation of 3D printers is restricted and subject of special permitting or licensing to and mandatory registration in appropriate government agency. Taking into consideration growing of transmission the digital files for 3D printing aims across frontiers, possibly in the future would have Customs duties imposes on electronic transmissions. At present, Customs duties on electronic transmission are not imposed due disputability of this subject.

As noted above, one of the pillars of Industry 4.0 are robots. Robots would be relevant use in Customs environment, for instance robots has acted as Customs agent in airports, seaports, or in other places where

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[4] Aska Cheong (2018): Cross-border ring using drones to smuggle smartphones busted. *NEWS of ChinaDaily*. Retrieved https://www.chinadailyhk.com/articles/192/48/173/1522315752387.html on 15 February 2020.

exists Entry-Exit border customs control points. Also, robots involved in operations from facial recognition of possible threats. In below example is shown how China use QIHAN's Sanbot (an artificial intelligence-powered humanoid robots) to Gongbei Port to act as customs agents. Through Gongbei Port where Qihan's Sanbot serves passed 99 million people in 2013. The robots have facial recognition technology to say if someone is lying and can also answer a series of various passengers' questions in 28 different languages. The first experience with QIHAN's Sanbot was very positive and Sanbots Company introduced next robot Sanbots Max QIHAN's Customs Inspector. Enrolled in November 2017, travelers going through the Shenzhen Bay Port were welcomed by the 1.45m tall customs robot who release the following message: "*Welcome to Shenzhen Bay Port, I am the electronic customs inspector. When leaving or entering China, all the passengers should abide by the laws and regulations of China Inspection and Quarantine and receive the health condition inspection.*"[5] The Sanbot Max QIHAN customs inspector includes ten functions such as: 1) temperature detection; 2) radiation detection; 3) low temperature detection; 4) intelligent declaration; 5) facial recognition; 6) electronic noise detection; 7) query services; 8) advertising; 9) guidance; 10) translation. At the Shenzhen Entry-Exit Inspection and Quarantine Bureau, the Sanbot Max smart service robot saves time for customs officers, it is well directed and supports more rigorous AI examination. It is the technology that allows China Customs Administration to equip their units at seaports and air terminals with the functionality in order to help detect potential security threats, alert human workers of questions and tasks beyond its capabilities. Sanbot intelligence robot to create "Intelligent Customs".

Generally, Sanbots categorized as the service robots powered by a cloud-enabled application ecosystem projected to be deployed in a broad variety of settings such as retail stores, schools and hospitals. The producer company calls this *"Robotics-as-a-service"*[6]. Robots increase performance and competitiveness, governments and companies must focus on developing the right skills to present and future employees to ensure an extension of the positive impact of robots on operations, job quality and remunerations. In the future robots and humans would be worked together, as robots supplement and increase labour.

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[5] Alice Mattews (2017): Introducing your new customs inspector. Electronic Specifier. Robotics. Retrieved https://www.electronicspecifier.com/industries/robotics/introducing-your-new-customs-inspector on 26 February 2020.
[6] Freddie Roberts (2016): Sanbot humanoid robot aids customs workers in China. *NEWS of Internet of Business.* Retrieved https://internetofbusiness.com/sanbot-humanoid-robot-aids-customs/ on 17 February 2020.
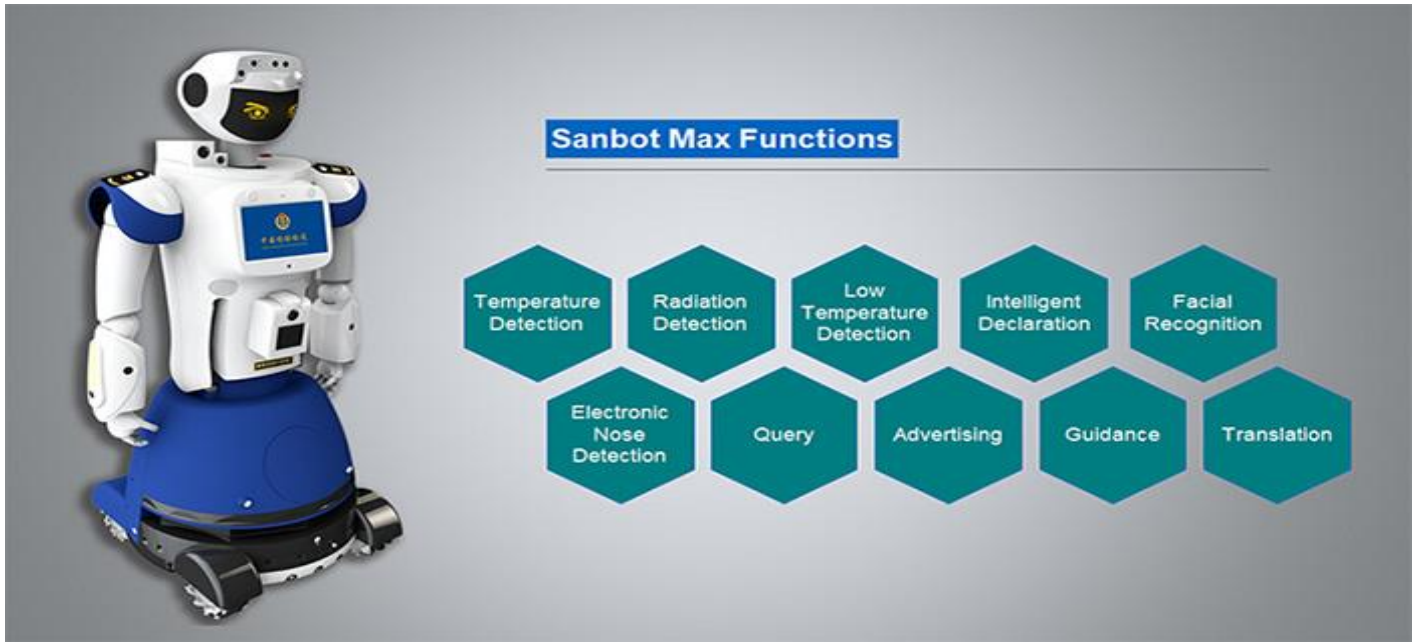
Figure 2: It shows how the Sanbot Max QIHAN humanoid robot looks and their functions. It is being used as a customs inspector in some seaports in China, source Electronic Specifier, robotics.

Another pillar of Industry 4.0 is Internet of Things (IoT). In last time IoT sufficiently benefited to the rise of e-commerce. The advantage of IoT is possibility for companies monitor the movement of commodities in real time and keep better decisions and saving of cost and time. Large business organizations use IoT to trace their shipments and develop the level of customer service through integrated supply chain network. Customs can connect to this integrated supply chain networks operated by economic operators in order to guarantee that trade facilitation and customs security requirements are satisfied in the movements through customs border. With data accessible through IoT technology, Customs Officials could be able to orient on applying tools to see priority shipment, identify flags for high-risk and low-risk cargoes as part of risk management, and ensure supply chain security.

Following on next pillar of Industry 4.0 so called virtual (VR), augmented and mixed reality, it is necessary to be aware how would Customs be benefitted from this? In order to differentiate, the real (physical) world is called "grounded reality." The virtual (VR), augmented and mixed reality helps to create a new world through the technology. For example, this can assist Customs during conducting a physical inspection or use for the visualization of big data kits. Also, virtual reality can be applicable for learning and development of Customs officers. Multiple types of learning environments possible to be designed that are really challenges to perform in physical world, for example the apparatus room of a large shipping vessel. Another example, the U.S. Customs and Border Protection (CBP), Office of Field Operations use the Virtual Training simulator system

for training of their Officers. The system with price USD 230,000 is an efficient tool expanding capabilities for CBP.

Biometrics adopted in our private and business operations, such as using fingerprints or retinal scan, voice and facial recognition. Some examples of using biometrics are accessing into our smartphone and accessing into offices or home premises with our faces through smart intercom. Nowadays at some airports exists facial recognition technology, and it is called "Biometrics Airports". In such airports for instance travelers can easy cross border using facial biometric characteristics against matches their official traveler identity. This technology way to a more seamless travel experience. Customs officials can also benefit with many possibilities in the progress of biometrics collecting face images for analytical purposes focused on customs security measures only. Direct access to the biometric data of natural persons who are involved in offences related to supply chain of goods (trade of commodities) and smuggling can help Customs administrations to spend less time to detect and investigate these offenders. Through biometrics access fraud identities could be easily detected. Biometrics in Customs can increase efforts of Customs officers in fight against criminals as part of law enforcement activity. As biometrics technology will be developed and broaden use in the future, potentially Customs can reduce the life of fraud business organizations to operate the global supply chain for criminal profit. Advanced technologies applying smart cameras with facial recognition, fingerprint readers and retinal scanners could certainly be integrated into workstations, entry and exit points, and other platforms of limited entrance to guarantee transparency and security of identity. It is becoming essential, as number of Customs brokers and other economic operators in the global supply chain move to online environment. Biometrics can take key place in supply chain security regimes, for instance as part of the verification of Authorized Economic Operator (AEO) certification and recognition.

All above presented information are focused to show the actuality and importance of selected subject for Customs purposes in digital age. Absence of broaden literature regarding this thesis topic, make research challenge. A review of online resources direct to websites of international public organizations such as World Customs Organization, European Union, United Nations, World Economic Forum, and National Customs Administrations such as State Customs Committee of Azerbaijan, U.S. Customs and Border Protection (CBP).

In the next chapters will be discussed broadly another advanced technology that would be made potential impact on Customs activities in generally. Also, will be looked at various systems based on information and communications technologies being used in Customs.

## 2. ORGANIZATION OF CUSTOMS

The system of customs is a set of bodies, constructed hierarchically in accordance with their roles and responsibilities. National Customs Administrations heads of the system of customs authorities, unites and directs their activities.

Customs are responsible for: 1) the procedure and conditions in respect of the movement of commodities and means of transport through the customs border; 2) levying of customs payments (taxes - VAT, excise; import and export duties); 3) organisation and performance of customs control (for fiscal, security, safety, health and protection of the environment aims); 4) customs formalisation of commodities and means of transport; 5) customs statistics of foreign trade; 6) supply chain security; 7) other law enforcement and regulatory activities. The state has exclusive right to develop a customs policy and ensure integrity of customs territory, and the centralisation of customs activity in the country. The state ensures such activity through establishing National Customs Administrations. In some countries Customs are independent structures (for instance, in Azerbaijan - State Customs Committee, in China - General Administration of Customs, in Russian Federation - Federal Customs Service). However in another countries Customs are integrated structures with Tax and Revenue, Trade or even Border Protection (for instance, in Turkey - Ministry of Trade and Customs, in the United States of America - Customs and Border Protection (CBP) Service, in United Kingdom - HM Revenue & Customs). The main legislation regulated directly or indirectly Customs activities in many countries are International Agreements and Conventions, Constitution, Customs Code, Criminal law and Administrative Law adopted by national governments. Customs has multipurpose and requires the satisfaction of the diverse interests and needs of present global trade and supply chain security. Thus, Customs activity has set of complex relations and tasks. In order to manage these complex relations and meet the required tasks during the digital age, customs bodies are improving, developing their capacity and applying advanced technology in daily operations. In modern age Customs would not be achieved key tasks such as global trade facilitation and compliance without using advanced technology, digital systems and high standards. World Customs Organization has designed the Framework of Standards to Secure and Facilitate Global Trade (SAFE Framework of Standards to Secure and Facilitate Global Trade). This document was adopted at its annual session in June 2005.

This original document adopted by announced in modern supply chain security standards and advertised the beginning of a new method to the end-to-end management of goods crossing through borders while recognizing

the importance of a closer cooperation between Customs and private sector. The SAFE Framework has since been constantly revision and renewed to effectively direct recent and progressive developments in the international supply chain. The World Customs Organization is an institute which plays a key role in a strong advocating of trade facilitation dedicating a good terms and conditions through its technical assistance to increasing the performance of National Customs Administrations. In more details about role and importance of World Customs Organization for National Customs Administrations and private sector will be discussed in next subchapter.

## 2.1. WORLD CUSTOMS ORGANIZATION AS PUBLIC BODY: VISION, MISSION, VALUES AND GOALS

The first stone in the establishing of World Customs Organization (WCO) was put in 1947 when more than ten European States represented in the Committee for European Economic Co-operation decided to establish a working group for purposes of creating Inter-European Customs Union with focus on the main principles of the General Agreement on Tariffs and Trade (GATT). The working group established two committees, first as an Economic Committee and the second as a Customs Committee.

The Economic Committee later became the Organization for Economic Cooperation and Development (OECD) and the Customs Committee was transformed to the Customs Cooperation Council (CCC). Legally creating the CCC was possible only based on the Convention adopted in 1952. The Council was body governing the CCC and first session was conducted in Brussels on 26 January 1953 with participation of seventeen European countries (Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey and United Kingdom).

Due increasing of authority and number of members the name World Customs Organization (WCO) was adopted by Council in 1994. The Headquarter of the WCO is based in Brussels, Belgium.

This reputable and reliable global intergovernmental institution has permanent members from 183 National Customs Administrations which participates in controlling and processing more than 98% of all global trade.

The vision of WCO is promoted as bringing Customs together for a safer and more prosperous world. The WCO slogan is *"Borders divide, Customs connects"*[7].

The mission of the WCO is focused on developing global standards, encourages cooperation and constructs capacity to contribute legal trade, to ensure a fair revenue collection and to preserve community, providing leadership, direction and aid to National Customs Administrations[8].

The WCO are a knowledge-based and action-oriented organization. It believes in transparent, honest, and auditable governance procedures, responsiveness to own Members, stakeholders in trade, and community. Another important values of the WCO are capitalize on technology and innovation, inclusiveness, diversity and opportunities for all.

Leadership, guidance and support to the WCO members are approved as Strategic Goals. The delivery of new initiatives ensuring more trade facilitation, more correct revenue collection and stronger security of the community are the way to achieve Strategic Goals. As part of the own obligation WCO will continue to establish, innovate and develop its tools and instruments for new Customs procedures. It will also continue to provide technical assistance to National Customs Administrations considering their requirements and will prepare guidance and new tools for effectively cooperation and collaboration.

The three Strategic Objectives of the WCO are stipulated as trade facilitation, revenue collection and protection of the community. In order to ensure the International Standards, the WCO has adopted four key packages so called: 1) the Economic Competitiveness Package (ECP); 2) the Revenue Package (RP); 3) the Compliance and Enforcement Package (CEP); and 4) the Organizational Development Package (ODP). For encouraging and better Cooperation purposes two strategic packages have been developed: first - Joint operations and exchange of information; second - Sharing of knowledge and best practices. In the area of Capacity Building WCO is a global excellence center and has designed already two strategic packages such as Technical assistance, training and tools for implementation of international standards and on people development. The WCO pays strong attention on Learning and Development. In this field is necessary to note use of technology and data, research and analysis as part of strategic packages. Organizational Capacity of WCO is aimed on two strategic packages: first - specialized and focused work allocation; and second - use of budget resources and accountability. Organizational

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[7] World Customs Organization: About us, WCO in Brief, WCO Vision Statement. Retrieved http://www.wcoomd.org/en/about-us/what-is-the-wco/vision_statement.aspx on 18 February 2020.
[8] World Customs Organization: About us, WCO in Brief, WCO Mission Statement. Retrieved http://www.wcoomd.org/en/about-us/what-is-the-wco/mission_statement.aspx on 18 February 2020.

Capacity packages will help to find and attract new talented people with leadership skills and promote a good governance, transparency and accountability of financial resources.

As we could see the WCO has exactly defined vision and understandable mission, strong values, and clear strategic goals and objectives.

## 2.2. STRUCTURE AND ACTIVITIES OF WORLD CUSTOMS ORGANIZATION

The WCO has a permanent Secretariat and three main Directors, located in Brussels (Belgium). The WCO manages by Secretary General, and currently Dr. Kunio Mikuriya from Japan is acting as Secretary General.
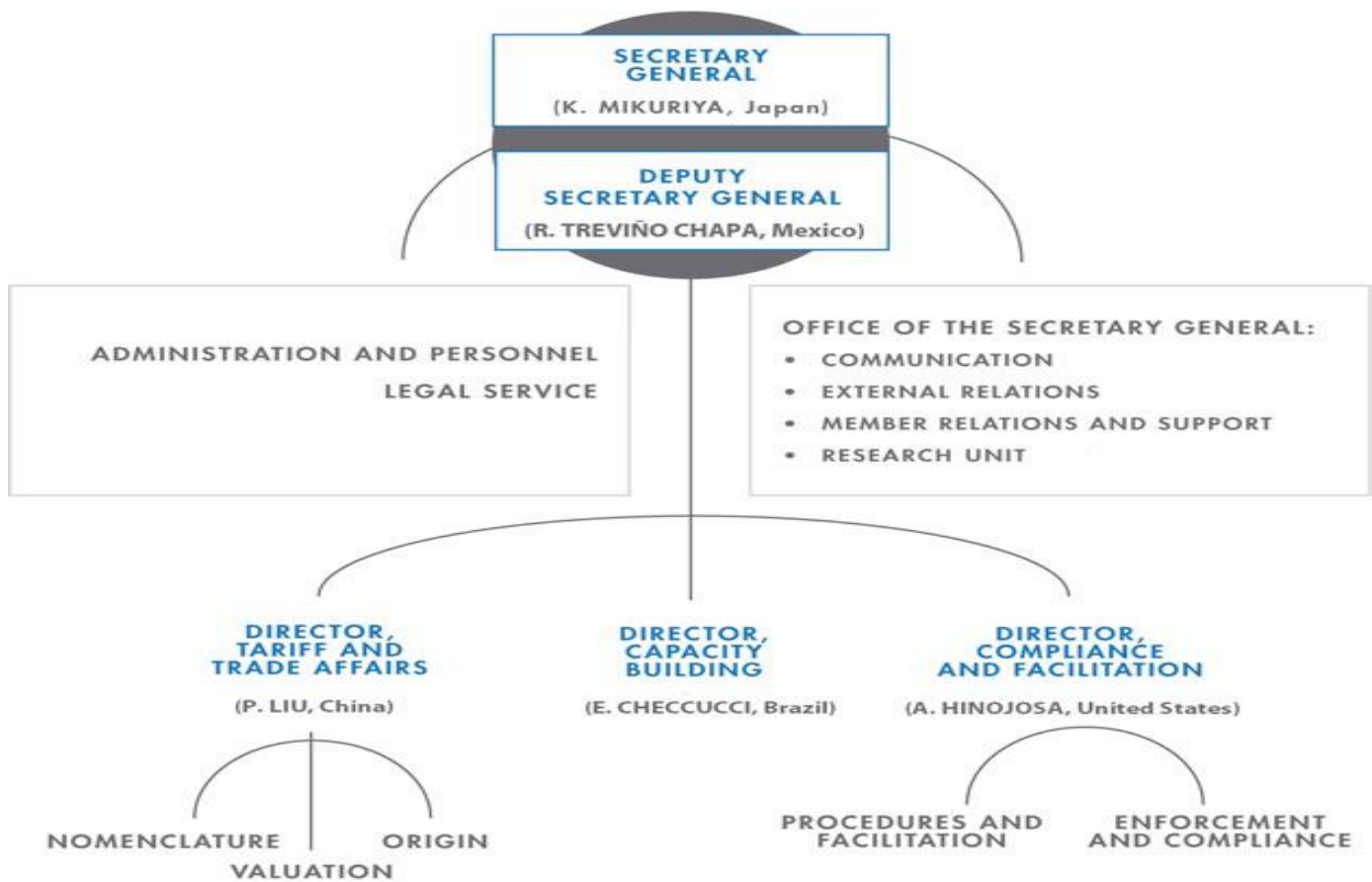
Chart 1: This chart shows the WCO main organizational structure. Source WCO, www.wcoomd.org.

The WCO Directorates are Tariff and Trade Affairs, Compliance and Facilitation, Capacity Building. Each Directorate has exact area of activity. Tarif and Trade Affairs Directorate is responsible on Harmonized System classification (HS Code), customs valuation and rules of origin (the non-preferential rules of origin) matters. Compliance and Facilitation Directorate is accountable for customs

compliance, law enforcement, customs procedures and global trade facilitation issues. Capacity Building Directorate provides following: 1) technical assistance; 2) learning and development with focus on increasing organizational capacity and modernization of the National Customs Administrations (members of the WCO); 3) coordination of capacity building activities. Also exists Council commission for Policy Enforcement, different working groups and committees within each Directorates with defined scope of work. For instance they are: 1) Working Group on Commercial Fraud; 2) Global Information and Intelligence Strategy Project Group; 3) Counterfeiting and Piracy Group; 4) Electronic Crime Expert Group; 5) Capacity Building and Integrity Committees; 6) Harmonized System Committee; 7) the Scientific Subcommittee; 8) Technical Committees on Customs Valuation and Rules of Origin.

The WCO actively conducts representation through Regional Bodies. It established Regional Intelligence Liaison Offices (RILO) in eleven countries covering different regions of the world (Caribbean, South America, Post-Soviet (CIS), Western Europe, Eastern and Central Europe, Central Africa, West Africa, East and Southern Africa, North Africa, Middle East, Asia and Pacific). RILO network provides support with exchange of information for intelligence purposes between WCO Headquarter and National Customs Administrations. Regional Offices for Capacity Building exists in six countries: Azerbaijan, Côte d'Ivoire, Kenya, Thailand, United Arab Emirates, Uruguay. Regional Training Centers exists in twenty four countries: Azerbaijan, Brazil, Burkina Faso, China, Dominican Republic, Egypt, Fiji, Hong Kong (China), Hungary, India, Japan, Jordan, Kenya, Lebanon, Kazakhstan, Kyrgyzstan, Korea, Malaysia, Mauritius, Nigeria, North Macedonia, Rep. of Congo, Russian Federation, Saudi Arabia, South Africa, Tunisia, Ukraine, Zimbabwe. These Regional Offices for Capacity Building are aimed on monitoring, controlling and supporting of projects in Customs and implementation of the WCO practices.

The WCO actively involved in developing of the legal instruments and tools, such as Conventions and Agreements, recommendations, declarations and resolutions, practical guides. The some key legal conventions adopted in Customs field by WCO were: 1) Convention establishing a Customs Co-operation Council (signed in 1950 and came into force in 1952); 2) International Convention on the Harmonized System (done in 1983 and came into force in 1988); 3) Customs Convention on the A.T.A. Carnet for the temporary admission of goods (A.T.A. Convention, done in 1961 and came into force in 1963); 4) The International Convention on the simplification and harmonization of Customs procedures (done in 1973, amended in 1999. After amendment it is called as The Revised Kyoto Convention, amended version came into force in 2006); 5) International Convention on mutual administrative assistance for the prevention,

investigation and repression of customs offences (it is known as Nairobi Convention, done in 1977, came into force in 1980); 6) Convention on Temporary Admission (it is called as Istanbul Convention, done in 1990 and came into force in 1993); 7) Customs Convention on Containers (under the auspices of the United Nations (UN) and International Maritime Organization (IMO) done in 1972 and came into force 1975).

The WCO participates in promotion and implementation of the Trade Facilitation Agreement (TFA) adopted by World Trade Organization (WTO), the agreement was done in 2014 and entered into force in 2017. The TFA includes articles for expediting the movement, release and clearance of goods, freedom of transit, border agency cooperation between customs and other align authorities on trade facilitation and customs compliance issues. It also contains articles for technical and information assistance, and capacity building in this field. TFA benefits equally private businesses (micro, small, middle and large enterprises) and users, and support diminish corruption.

Chart 2: Chart shows World goods exports and imports by scale of development, 2012Q1-2019Q2. Volume index, 2012Q1=100. Source WTO News, Press releases 2019: Trade Statistics and Outlook. www.wto.org.
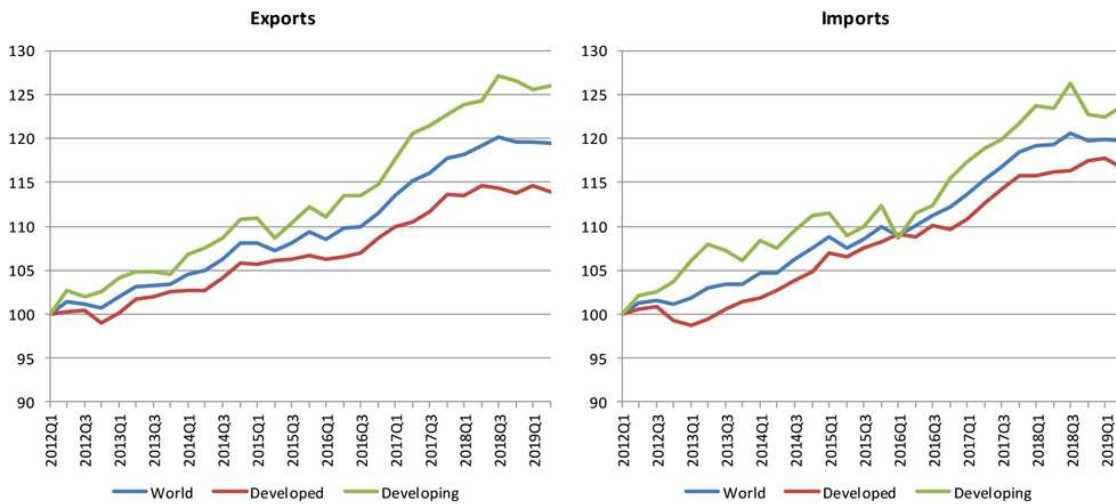


World merchandise trade volumes projected to increase in 2020 by 2.7%. Above presented chart about world merchandise exports and imports by level of development shows that trade activity was still high on global level in past years and will be grow in 2020. It means Customs administrations still are key players of supply chain circle and revenue collection. In global digital trade age Customs must better compromising between trade facilitation, compliance and law enforcement. For these purposes the WCO conducts cooperation with partner organizations in order to create better trade environment and update customs practices, ensures transparency, visibility and further commitment for upgrades and reforms. For instance, the WCO cooperates with Business Organizations, they are following: 1) BIC-The Bureau

International des Containers et du Transport Intermodal; 2) Global Express Association (GEA); 3) International Chamber of Commerce (ICC); 4) International Federation of Customs Brokers Associations (IFCBA); 5) International Federation of Freight Forwarders Associations (FIATA); 6) International Air Transport Association (IATA); 7) International Air Cargo Association (TIACA), 8) International Road Transport Union; 9) International Association of Ports and Harbors (IAPH); 9) International Standard Association (ISO). It also cooperates with Academic Organizations, International Public and Finance Organizations, Regional Intergovernmental Organizations such as: 1) World Bank, Organization for Economic Cooperation and Development (OECD); 2)World Trade Organization (WTO); 3) International Trade Center (ITC); 4) International Maritime Organization; 5) INTERPOL; 6) European Union; 7) EUROPOL; 8) Eurasian Economic Community (EAEC), and many others. The WCO Council established Private Sector Consultative Group (PSCG) in 2005. Participants of this Group mainly represents different businesses, producers and professional associations. PSCG have 26 members (IBM, Microsoft, Huawei, Michelin, Baker Hughes a GE Company, others). PSCG is a bridge between global Customs and private sector. This way of cooperation supports better understanding business requirements and needs from private sector perspectives, bringing data and advising WCO on global trade matters. Another source of cooperation between WCO and private sector is WCO Academy. WCO Academy is innovative E-learning platform for gaining fundamental knowledge and development competence on different customs related subjects, including best practices from technical experts of WCO.

The WCO leads other various activities such as programs in Security, Drugs and Precursors, Preventing Money Laundering and Combating Financing of Terrorism, Cyber Crime, Environment, Intelligence and Risk Management, Intellectual Property Rights (IPR), Health and Safety, Revenue, Cultural Heritage, Illegal Wildlife Trade areas.

The latest achievement of WCO was acceptance a new Strategic Plan for the four years (2019-2022) period, defining nine primary tasks. The WCO Secretariat decided to target on following areas: 1) Coordinated Border Management (Singe Window Environment); 2) Safety and Security; 3) the Revised Kyoto Convention; 4) E-Commerce; 5) the Harmonized System (Nomenclature); 6) the Capacity Building Strategy; 8) Performance Measurement; 9) Integrity; 10) Digital Customs and Data Analytics. As part of these prime tasks WCO will develop a Digital Customs Package, bringing all necessary information on disruptive technology and sharing available practices with National Customs Administrations. A Digital Customs Package would be supported National Customs Administrations to set up new approaches

to gather, exchange, and analysis of data. Meanwhile the Artificial Intelligence is going to become superior technology in global Customs environment, that would be used broadly for instance in risk management.



Picture 2: On photo Cargo and Vehicle Inspection System (Non-intrusive inspection technology (NII)), Belgium Customs. Source WCO News No.89, www.wcoomd.org.

Another achieved milestone of WCO is the UFF (Unified File Format) Development Program. Since 2016, the WCO has been working with the concept to create a standard NII (Non-Intrusive Inspection, such as X-ray or gamma-ray imaging type equipment) data format. A standard NII is aimed to be *"universally deployed"*[9]. After creating NII standard, the UFF will largely contribute "*the interoperability of NII systems supplied by different manufacturers*, *as well as the exchange of images within and between Customs Administrations"*[10]. The UFF team included experts from four NII manufactures (L3, Nuctech, Rapiscan Systems AS&E, Smiths Detection) supported by the WCO technical specialists. The program was completed in three phases. After development the UFF 2.0 architecture together with UFF converters and viewers device, they were successfully tested by Dutch Customs that uses NII equipment from all above noted producers. The further tests in another Customs Administrations on NII equipment both new and old version produced reliable results (minimal or no errors for converted images). The converted images from different NII equipment was then open through UFF 2.0 viewer (image viewing software). Each file converted into a UFF output produced a unified version with equal image quality. The main idea of this program to set up a better way for exchange of

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[9] Vyara Filipova (2019): Customs and industry collaborate to develop a unified file format for non-intrusive inspection devices. *WCO NEWS No. 89, Magazine*. Publisher: World Customs Organization. Retrieved https://mag.wcoomd.org/uploads/2019/06/WCONews_89_UK.pdf on 19 February 2020.
[10] Ibid.

information between National Customs Administrations in order to ensure strong compliance mechanisms, warn, identify, investigate and prosecute crimes in Customs field.

The WCO activities bring the multiple benefits to international trade participants (importers and exporters) and consumers, promoting new approaches, instruments, tools and using digital technologies for trade facilitation, health and safety of society, and security of people. From other side, WCO supports strategy for upgrade with strong focus on computerization, digitalization in Customs. The role of computers and digital software are crucial in the way of simplification procedures, and the use of data produced by computer systems to effectively control customs operations. National Customs Administrations by using agreed international standards which promoted by WCO will be aligned to international practices and countries can be more fully integrated into the global supply and trading community. In 2003 WCO introduced 1.1 version of WCO Data Model. The WCO Data Model updated several times during years and the latest version now is 3.8 which was released by WCO Data Model Project Team (DMPT) supporting with Information Management sub-committee (IMSC) in 2018. This innovative data exchange tool is *"a set of carefully combined data requirements that are mutually supportive and which will be updated on a regular basis to meet the procedural and legal needs of cross-border regulatory agencies such as Customs, controlling export, import and transit transactions. It is consistent with other international standards such as the United Nations Trade Data Elements Directory (UNTDED)"*[11]. The members of industry and trade, other international organizations supporting trade facilitation efforts and data standards are also users of WCO Data Model. The major benefit of using this model is paperless which decreasing the cost of documentation and less time consuming for controlling procedures by regulatory services. IT solution providers for global trade are also much benefited from this model.

Through above running initiatives and upcoming the new ones WCO tries to do more trade simplification and deals with design Globally Networked Customs which would be raised close cooperation between National Customs Administrations and businesses via real time data exchange of relevant trade-commercial documentation. Broaden use of Emerging technology within the international customs environment assists to get better efficiency and effectiveness, lower cost and save time associated with customs clearance. Using by National Customs Administrations digital systems such as Electronic Data Interchange Systems (or EDI) or

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[11] World Customs Organization (2009): WCO Data Model: cross-border transactions on the fast track. Retrieved http://www.wcoomd.org/-/media/wco/public/global/pdf/topics/facilitation/instruments-and-tools/tools/data-model/dm_brochure_en.pdf?la=en on 20 February 2020.

Single Windows (SW) provides greater interconnection within a given state and between various states when administering customs procedures. Within users of EDI and Single Window System, for instance Azerbaijan State Customs Committee, Australian Customs Service, General Administration of Customs of the People's Republic of China, National Customs Administrations of Member States of the European Union, Ministry of Customs and Trade of the Turkey Republic, U.S. Customs and Border Protection Service. As per IBM Company "*EDI is the intercompany communication of business documents in a standard format. With EDI, the information moves directly from a computer application in one organization to an application in another. EDI standards, which specify what information goes where in an EDI document or message, eliminate the need to manually rekey information so that it can be accepted. This automated capability enables information to be shared rapidly*"[12]. Nowadays Customs collaborate with private sector, being greater aware on requirements of commerce in digital age, trying to transform much more areas of customs activities into digital. These works have done partially and already provide paperless services using automation and supports positive user experience, improving productivity, effectiveness and reducing errors and deviations for better quality. Another good example in respect of EDI application, was jointly cooperation between China and Pakistan Customs Administrations, in 2018 they launched trial operations through EDI system. The Customs EDI system manage electronic data such as certificates of origin and export customs declaration for import-export commodities under the China-Pakistan Free Trade Agreement. However, some gaps in receiving trade data from China under Electronic Data Exchange Mechanisms exists, adding challenges for Pakistan Customs and it is not assisting Pakistan authorities *"fully to overcome under invoicing in the amount of $ 4 billion"*[13], as reported in the Pakistan News International (December 2019). Provision of the full fledge data under EDI system by China Customs could effectively prevent trade-based money laundering, under invoicing and over invoicing issues. Thus, China-Pakistan Customs Administrations found mutual understanding and agreed to cooperate for provision fully fledged data in real time which will lead also to quality of data.

Two main types of EDI transmissions are Point-to-Point (known also as Direct Connections) and Value-Added Networks (VANs). Direct Connections enables organizations connect and exchange data with no intermediary over the internet via a secure protocol. VAN is third party network, it runs information transmission, provides a flexible computer interface and an electronic mailbox service. EDI system will serve

[12] IBM Company website. Retrieved https://www.ibm.com/supply-chain/edi-electronic-data-interchange on 20 February 2020.
[13] Mehtab Haider (2019): China asked to provide real-time data to avoid under invoicing. The News (International). Retrieved https://www.thenews.com.pk/print/582255-china-asked-to-provide-real-time-data-to-avoid-under-invoicing on 20 February 2020.

as the main platform to provide document exchange, with capability to support emerging technologies such as the Internet of Things (IoT), blockchain and artificial intelligence (AI). EDI system will use IoT sensors, Blockchain technology, AI agent in the future.

Development of advanced technologies for processing import and export customs declarations and the levying of tax and duties requires significant financial and human resources to support the high cost of development, a high level of expertise to design and develop the system. The acquisition of an emerging technologies is recommended for all National Customs Administrations. These emerging technologies have the great application area and operational advantages, and thus it is important to build recent developed IT infrastructure in Customs. And of course, as part of this acquisition National Customs Administrations should prepare skilled customs operators with abilities confidently understand and use effectively emerging technologies.

National Customs Administrations and the participants of the global Customs network are truly committed to perform activities focused on ensuring "Sustainability for People, Prosperity and the Planet" that includes following on international standards and sharing relevant knowledge and experiences. In 2020, WCO acts under the slogan *"Customs fostering Sustainability for People, Prosperity and the Planet"*[14] the Customs Administrations and align partners will be focusing on the contribution for Serving the People, Ensuring the Prosperity, and Protecting the Planet.  The WCO members conducts activities in frontline of borders, thus they have a great position to use efforts for security, safe and health, global supply chain security, trade facilitation.

## 2.3.    AZERBAIJAN'S STATE CUSTOMS COMMITTEE AS MEMBER OF WORLD CUSTOMS ORGANIZATION

The Azerbaijan Republic declared its independence from USSR on 30 August 1991 (before independence it was known as Azerbaijan SSR being one of the fifteenth Republics of the Union of Soviet Socialistic Republics), and the modern Azerbaijan Customs System was established on 30 January 1992.

The State Customs Committee of the Republic of Azerbaijan is the central executive body that implements state policy and regulation in the area of customs activities and has the status of law enforcement agency.

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[14] Kunio Mikuria (2020): Message on International Customs Day 2020. 2020 Customs Fostering Sustainability. World Customs Organization. Retrieved http://www.wcoomd.org/en/about-us/international-customs-day/icd-2020.aspx on 20 February 2020.

Picture 3: Baku, Azerbaijan. Source TradeLens, www.tradelens.com

The Azerbaijan's Customs has map of activities which in major are defined as follows: 1) participates in the design of a uniform state policy in Customs and ensures the implementation of this policy; 2)organizes of customs activity and ensures its development; 3) conducts law enforcement activity; 4) conducts regulatory activity in Customs; 5) develops application of advanced customs regulation tools in the Republic of Azerbaijan.

The State Customs Committee of the Republic of Azerbaijan became a member of the World Customs Organization on June 1992. Also, the State Customs Committee have some representations in the WTO's Financial Committee (1999) and Higher Organization-Political Commission (2002) and Customs Cooperation Committee (2002), signed the Partnership and Cooperation Agreement with the EU and its members in 1996. It collaborates with UN Institutions, World Bank, International Monetary Fund, the Black Sea Economic Cooperation (BSEC), IRU World Road Transport Organization, and many other international public and private organizations within the scope of work. Azerbaijan's Customs participates in delivering a sustainable economic world. It collaborates on bilateral and multilateral levels with many organizations.

The Customs legislation of Azerbaijan was improved and updated tremendously since 1992. Nowadays, Azerbaijan's Customs mainly governed based on: 1) Constitution of Azerbaijan; 2) Customs Code and other laws of Azerbaijan; 3) Azerbaijan's President Decrees and Orders; 4) Decisions and Orders of the Cabinet Minister of Azerbaijan; 5) adopted by Azerbaijan Government relevant International Agreements and Conventions (where Azerbaijan is contracting party); 6) Azerbaijan's State Customs Committee Regulation.

As a result of productive activities of Azerbaijan's Customs, the Government of Azerbaijan adopted main International Agreements and Conventions in Customs area, such as: 1) Customs Convention on the International Transport of Goods under Cover of TIR Carnets (TIR Convention); 2) International Convention on the Harmonized Commodity Description and Coding System; 3) International Convention on mutual administrative assistance for the prevention, investigation and repression of Customs offences (known as Nairobi Convention); 4) International Convention on the simplification and harmonization of Customs procedures (known as Kyoto Convention); 5) Customs Convention on Containers, and such.

The main tasks of Azerbaijan's Customs within the scope of activity are stipulated as following: 1) ensures economic and national security; 2) supports health and safety of society as well as rights of consumers in respect of imported goods; 3) revenue collection; 4) performs tariff and non-tariff regulatory measures in respect of the movement of goods through customs border; 5) trade facilitation; 6) customs clearance of goods and means of vehicles; 7) customs control and customs formalities; 8) export control on dual use goods; 9) trade and supply chain security; 8) counter against crimes in the area of Customs; 10) combat illicit trafficking of drugs, psychotropic substances and their precursors, weapons, ozone-depleting substances; 11) fight against illegal movement cultural, historical and archaeological values of people; 12) protection intellectual property (IP) rights; 13) counter against human being trafficking, 14) prevent the illicit movement of plant species and other goods across the customs border. They also support and conduct the following activities: 1) cash (monetary) control; 2) fight against financing terrorism and trade based money laundering; 3) participate in the development of international treaties on customs issues; 4) ensure commitment on the recognized international obligations; 5) conduct research and development; 6) sets up new information system and technologies in Customs; 7) creates electronic models of customs procedures and electronic information systems of customs services; 8) develops of information resources; 9) acquires emerging technologies and equipment

for improving the risk management system as part of customs control; 10) ensures Customs modernization.

The single Azerbaijan's Customs system consist of: 1) the State Customs Committee of the Republic of Azerbaijan with Headquarter (Secretariat) in Baku; 2) field head customs departments (the largest are Baku Head Customs Department, Sumgayit Head Customs Department), 3) specialized head customs departments (Head Customs Department of Air Transport, Head Customs Department of Energy Resources and Marine Transport, Head Customs Department of Excise Goods); 4) customs offices, 5) other departments such as Customs Academy, Central Customs Expertise Department-Customs Laboratory, Dog Training Center and Nakhchivan[15] Customs Committee.

The Azerbaijan's Customs has strategic vision and mission with clear understanding of the organisation position in the future, which will drive effectively customs activities in new circumstances of digital age. The vision statement of Azerbaijan's Customs defined as "*Customs Service of Azerbaijan shall be recognised as innovative, powerful, stable and completely automated service, known for professional, transparent and high quality services by partners, being part of international security system while supporting international trade development and international cooperation*"[16]. The conditon of mission statement of Azerbijan's Customs promoted as "*protection the sovereignty, economic and national security, preservation the health of the country's population, improve the social welfare of nation through the use of best international practices, facilitate international trade and at the same time ensure security, minimize citizen-clerk contact, collect and transfer customs payments to the state budget, as well as combat customs offenses and international terrorism*"[17].

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[15] Nakhchivan (*Naxçıvan* is original name in Azerbaijan language) is a region in the territory of the Republic of Azerbaijan. This region has the status of Autonomous Republic. Retrieved http://dgk.nmr.az/az/article/1206/ 21 February 2020.
[16] State Customs Committee of the Republic of Azerbaijan: Committee, Vision and Mission. Retrieved https://customs.gov.az/en/komite/missiya-ve-geleceye-baxis/ on 21 February 2020.
[17] Ibid.
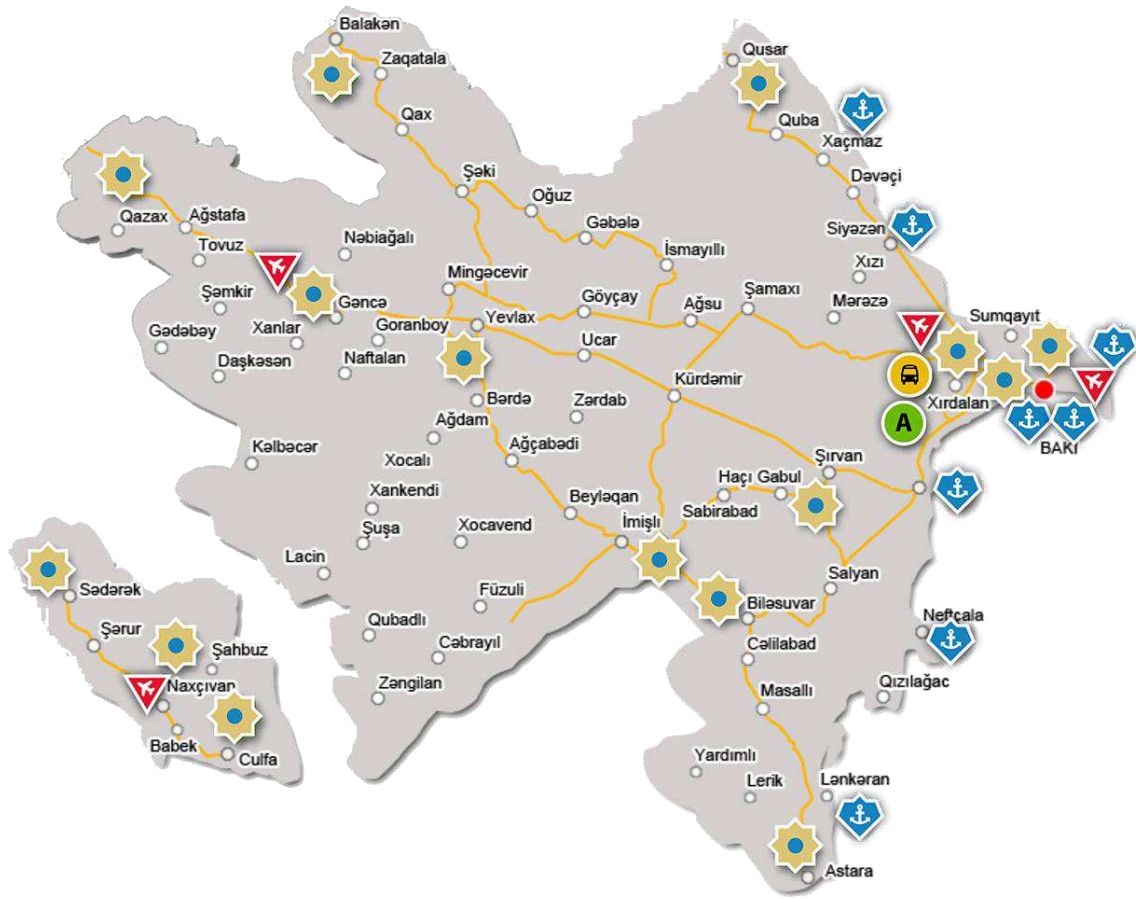
Map 1: A map shows the present Customs points on the territory of the Republic of Azerbaijan. Source www.customs.gov.az.

Azerbaijan's Customs is committed to institutional reform and modernization, as part of the announced type of activities. Moreover, Azerbaijan's Customs increases leadership role at World Customs Organization. In June 2019 Azerbaijan's Customs hosted WCO IT/TI Conference and Exhibition. During this event emerging technologies in Customs was discussed and private sector shared with latest achievements in IT area, specifically in Blockchain. Azerbaijan's Customs is aimed on transparency and trade facilitation, supply chain security through using advanced technologies. As part of this strategy several innovative projects had been launched in past. For instance, the most successful project was creating Single Window (SW) System, the integrated and automated governance system for customs clearance and control. The legal foundation for implementation of the SW system was done in 2008 by Presidential Decree. Single Window performs electronic data exchange and ensures paperless and reducing time for customs formalization and release of commodities and means of vehicles through customs border. The other similar project executed by Azerbaijan's Customs was United Automated Management System (original name of system VAIS). This system also is focused on paperless

mechanism and supported for instance such applications as: 1) electronic payment of customs duties and taxes; 2) electronic registration of customs violations; 3) automated risk management; 4) electronic data transmission; 5) electronic management of staff; 6) electronic management of enterprise resources; 7) exchange data with organizations directly or indirectly involved in the process of border crossing and customs clearance of goods; 8) exchange of data with other countries on customs issues; 9) provides e-services for banking, transportation organizations and foreign economic operators; 10) electronic observation for customs formalization of commodities and means of vehicles crossing frontier.

The other milestone of Azerbajan's Customs in applying on emerging technology became signing of agreement in June 2019 for joining TradeLens, blockchain-enabled supply chain platform, jointly developed by Maersk GTD Inc. and IBM. This innovative blockchain platform aligns with Azerbaijan's Customs strategy for achieving fully automate customs clearance processes and boosting trade facilitation. This platform will help Azerbaijan's Customs to have general picture on transactions within TradeLens ecosystem, get data on shipments in containers on early stage and efficiently manage risks, deliver faster clearance processes, make safer import and export operations, reducing cost of trade and increasing quality of data. TradeLens has dozens of participants (more than one hundred) and being handled over ten million separate shipping events and big volume of documents weekly.



Picture 4: The Regional Office for Capacity Building (ROCB) for the World Customs Organization (WCO) Europe Region in Baku, Azerbaijan. Source www.rocb-europe.org.

In 2011 as part of Azerbaijan's Customs initiative was opened the Regional Office for Capacity Building (ROCB) of the World Customs Organization (WCO) Europe Region. The goal of this Regional Office in Baku supports upgrading Customs Services by reviewing the global changes, trends and standards, Customs in the

21st century concept and Revised Kyoto Convention and other legal tools. In 2019, the State Customs Committee of Azerbaijan was approved as WCO Europe Region Vice-Chair. Based on WCO's recommendations and own strategy Azerbaijan's Customs will follow on innovations and disruptive technologies for trade facilitation and supply chain security on regional and global level.

Azerbaijan's Customs together with UK Border Guard participates in the joint project Hunter, a joint memorandum was signed on February 2019. The main goals of this cooperation exchange of advanced practices on gathering Advance Passenger Information (API) and Passenger Name Record (PNR), analyzing data on shipments and individuals crossing borders by streamlining customs and frontier procedures.

As part of law enforcement activities, Azerbaijan's Customs participate in international initiatives to reduce transnational crime. Azerbaijan's Customs is participant of the Global Container Control Program (CCP). It implements joint activities together with United Nation (U.N.) Office on Drugs and Crime, Central Asia Regional Information and Coordination Center (CARICC), and World Customs Organization.

Using X-ray metal analyzers and X-ray machines Azerbaijan's customs improved detection capabilities for contraband of illegal goods and narcotic drugs. Today Azerbaijan's Customs uses X-ray for scanning vehicles at the main customs point of entry (ports, terminals) into Azerbaijan and working constantly for improving skills of operators for such equipment. As part of learning and development efforts, in 2018 was hold special training for Azerbaijan's customs officers on the rules of operation of Hi-Scan-Hi-Trax II X-Ray inspection supported by World Customs Organization (WCO) European Regional Office for Capacity Building in Baku. The WCO actively supports Azerbaijan's Customs to build strong capacity in the field of X-ray image analysis and non-intrusive inspection (NII) equipment. For instance, one successful story of using advanced technology for combat of illegal drug happened in July 2018, when Azerbaijan's Customs stopped the suspicious vehicle and examined it bases on risk assessment analysis, using X-Ray equipment and a dog service. As a result of examination 260 kg heroin (it is one type of drugs) was seized by Customs of Azerbaijan at Iran-Azerbaijan border. The forensic expertise conducted by Azerbaijan's Forensic Examination Center confirmed that contents of seized polyethylenic bags was *"home-made heroin"*[18]. The illegal drugs were addressed for delivery from Iran to Ukraine (see photo below).

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[18] The State Customs Committee of Azerbaijan Republic (2018): 260 kg heroin heading to Ukraine seized in Azerbaijan. News. Retrieved https://customs.gov.az/en/faydali/xeberler/2750 / on 22 February 2020.

Picture 5: In polyethylene bags contains home-made drugs (heroin), seized by Azerbaijan's Customs (2018). Source www.customs.gov.az/en/.

All efforts of Azerbaijan Customs are aimed to promote uninterrupted movement of goods via protected international trade supply chains using as much as possible non-intrusive inspection equipment and radiation detection equipment, minimizing cost and reducing time of customs control and clearance, without breaking the stream of legitimate trade.

## 3. USING ADVANCED TECHNOLOGIES IN CUSTOMS

Introducing new technology and innovations are key in Customs. Data, Digital and Disruptive technologies shape the future of global Customs. The World Customs Organization (WCO) has developed some IT tools and data model standards, which are available for using by National Customs Administrations. These tools for instance are: 1) National Customs Enforcement Network (nCEN) application; 2) Cargo Targeting System (CTS); 3) Global Travel Assessment System (GTAS); 4) WCO Data Model standards and the Unified X-ray file format (UFF) which in addition supporting IT tools. All these tools generally are targeted on following: 1) for collecting, storing, analyzing and spreading law enforcement data more effectively at the domestic level; 2) for formation sound intelligence capabilities and strengthen profiling; 3) for identifying high-risk cargoes at import, export and transit levels and secure against all possible Customs threats; 4) for collecting and exploring passenger data; 5) for the harmonization of electronic data requirements; 6) for the harmonization of data generated by non-intrusive (NII) inspection equipment.

First using emerging technologies in Customs increases efficiency and security of Customs transit procedures. Second innovations in Customs changes the customs processes and mechanisms. Third it gives quicker results, makes movements of goods and vehicles more secure. Fourth passengers crossing faster through state borders. Another possible advantage are elimination administrative barriers, provision transparency of customs activities and adding more economic value.

Today customs in majority countries operate in E-customs environment. E-customs means zero paper base customs declarations, conducting customs control in respect of shipments based on pre-arrival/pre-departure electronic information and risk analysis methods, fast customs decisions.

### 3.1. WHAT IS CUSTOMS TECHNOLOGY?

The Encyclopaedia Britannica defined technology as *"the application of scientific knowledge to the practical aims of human life or, as it is sometimes phrased, to the change and manipulation of the human environment"[19]*. Technology developed over time and the role of Information and Communication Technologies (ICT) in Customs is absolutely. Full computerization in Customs aligns with Customs modernization strategy.

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[19] Encyclopaedia Britannica. Retrieved  https://www.britannica.com/technology/technology on 22 February 2020.

Indeed, starting in the 1970s, National Customs Administrations of many developed economies began to accept the essential features of applying technology-based solutions in order to develop processes.

The legal base of ICT is promoted in WCO Revised Kyoto Convention. In chapter 7 of the Convention named Application of Information Technology under article 7.1. Standard has noted that *"the Customs shall apply information technology to support Customs operations, where it is cos-effective and efficient for the Customs and for the trade"* and under article 7.2. noted *"when introducing computer applications, the Customs shall use relevant internationally accepted standards"*[20].

Information and Communication Technology in Customs is defined as "*the management, acquisition, processing, storage and dissemination of vocal, pictorial, textual and numeric information by a micro-electronic based combination of computing and telecommunications"*[21].

It is true that IT has an increasingly essential role in customs administration of 21st Age, but priorities, proficiency, facilities, and of course resources of each National Customs Administration differ sufficiently. However, designing new, facilitated practices and processes powered by global best practices from WCO and private sector has brought positive results in customs operations. Customs manages revenue collection (levying tax and duties for imported and exported goods) and border enforcement, has key responsibilities for goods control. Effective revenue management at the border should be projected via IT system, in order to provide fast and united revenue administration as well as to control inspection and examination of goods. The modern National Customs Administrations has a high level of relation on the application of ICT. Request from economic operators for more effectiveness in trade facilitation and compliance keeps on to stress Customs into looking at new initiatives and investments (directly or through donors) on IT area. Advanced systems for risk management and Single Window include complex and emerged technologies and undoubtedly request big investments in software applications and e-services.

Progressively changing in ITC industry also affected to Customs behavior and operational environment. They must react on such kind of changing adequately and look at new possibilities in the market, acquiring new ICT technologies.

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[20] World Customs Organization. Topics. Procedures and Facilitation. Instruments and Tools. Revised Kyoto Convention. Retrieved http://www.wcoomd.org/es-es/topics/facilitation/instrument-and-tools/conventions/pf_revised_kyoto_conv.aspx on 22 February 2020.

[21] World Customs Organization. Kyoto Convention. General Annex. Chapter 7. Guidelines on Application of Information and Communication Technology (2014), Version 7. Retrieved http://www.wcoomd.org/-/media/wco/public/global/pdf/topics/wto-atf/dev/ict-guidlines.pdf?la=en on 22 February 2020.

As a result of the latest Customs efforts in automation, modern customs processes are simple and transparent, but not simplistic. The other feature of automated customs processes is moving from physical to post customs clearance control, it is targeted for audit of transactions in which the risk of under-declaration is greatest.

## 3.2. WHY DO CUSTOMS USE ADVANCED TECHNOLOGY?

Today Customs is promoted the open system philosophy. It means opportunity to exchange data electronically by a type of various means with business and non-business entities, with other public agencies on domestic and global level. Customs understands that already majority of businesses operates in environment with big volume of intra-company transactions, in which row materials, components, and partly processed or completed products are being shipped across national borders, within integrated business management systems and increasingly decreasing required time frames. Some businesses which do not have intra-company transactions systems, also looking for an outsource opportunities in order to follow on these highly demandable electronic transaction management systems. Outsource opportunity it such kind of professional advice and support from global freight forwarding suppliers to these companies.

The design and implementation of bi-lateral and multi-lateral agreements for Customs-to-Customs mutual assistance to ensure and use single management of common approved controls and, procedures are the way to modern Customs control. It would be a major innovative response to well-positioned and fast broaden business practice existed today.

Customs actively cooperate with private sector and conduct projects which will help trade facilitation. In this situation using appropriate ICT systems with data sets and communication standards are mutually benefited for Customs and businesses. However, practice has shown that while relevant technologies are already applicable, existing international and national legal agreements, regulating the movement of goods and data will need to adjust or completely change.

Just-in-time (JIT) techniques have resulted in a multiplication of small, repetitive and frequent deliveries. As, for customs clearance purposes, each delivery must provide its own packet of relevant control data, this could have posed serious data processing problems. However, freight forwarders, in all modes of transport, are already using ICT to maximize supply chain efficiency. Customs, using appropriate E-commerce (EC) systems and a broadening level of electronic data interchange (EDI) mechanisms, has opportunity to get benefit from these well-operated data flows to manage their own risk-assessment and release procedures.

Many National Customs Administrations have accepted, EDI applications using standard message formats, specifically UN/EDIFACT. For ensuring compatibility of these messages, it was advised by World Customs Organization that all relevant EDIFACT systems should be produced on basis of the EDIFACT maps as guided in WCO Data Model.

Using advanced technologies in Customs have certain benefits. The benefits are provision reliable customs control, rational and productive customs formalization, uniform application of Customs law, more efficient revenue collection, more effective Data analysis, efficient producing external customs statistics and improved Data quality.

Potential application areas of Information and Communication Technology in Customs are following: 1) Cargo Inventory Control; 2) Goods Declaration Processing (import, export, transit, inward and outward processing, and such); 3) Pre-arrival and pre-departure declaration processing; 4) Management of Licenses, Permits, Certificates, Release Notification, Customs Enforcement, Selectivity (including risk assessment and targeting); 5) Advance Passenger Processing; 6) Revenue Accounting; 7) External Trade Statistics; 8) Management Information Systems (MIS); 8) Reporting, Data Storage; 9) Trader Partner registration and Management of Authorized Economic Operator (AEO) Programs; 10) Office Automation; 11) Customs Intranet and Extranet. Some National Customs Administrations of developed countries have implemented in-depth this kind of systems, but in less developed or developing countries only the limited functions have been automated or automation is restricted in number of ports or airports. In many scenarios systems have capacity share hardware (central processor, VDUs, printers, telecommunication network and computer files). Customs IT systems based on an integrated information architecture and consist with the application subsystems and relevant databases, which step to a close integration between the different business functions. The examples of Application sub-systems and databases are following: 1) Import declaration processing system; 2) Export declaration processing system; 3) Transit declaration processing system; 4) Excise declaration processing system; 5) Excise movement and control system; 6) Drawback system; 7) Risk management system; 8) Enforcement system; 9) Trading partner registration database; 10) Integrated tariff database; 11) Revenue accounting database; 12) Selectivity database; 13) Deferred payment database. Above listed subsystems of an automated system in Customs support the fundamental Customs activities for goods processing. Interfaces allows information systems to communicate with each other.

Common problems of ICT in Customs are lack of infrastructure, automation of source data, customs legislation, resource and expertise limitation.

Customs use Outsourcing, Insourcing and Off-shoring in ICT area. Outsourcing means when an organization procure products or services or delegates some of its functions to an external party. Off-shoring occur, when the activity is identified for outsourcing, is performed in another country. Outsourcing can be performed inside as well as outside of the country. The noncore Customs activities which can be outsourced, for instance are next: 1) Management and Operation of the Customs IT Management; 2) Application Management and Maintenance; 3) Call Centre and Help Desk Services, and such. However, Customs should not outsource its core functions in such areas as security, enforcement of restrictions and prohibitions, protection of society, collection of revenues. Customs can be benefited greatly from Outsourcing of ICT in way of getting opportunity to be focused on core business functions, and in case not having internal resources use accountability and quality of external resources available in exchange of payment. The problems of outsourcing are security, quality of service, human resources issues.

The process of using an electronic information exchange system in Customs based on approved international standards. Data transfer lines in Customs used the following: 1) physical delivery of magnetic media (for instance, tapes and disks) through post services; 2) point-to-point data transmission (means both systems must be available and open to get data simultaneously); 3) communication networks (supports exchange information through an electronic mailbox, managed by the communication network). An example of communication network, that would be used by Customs is Value Added Network (VAN). VAN is a private, hosted service that can provide a secure way to accept, send and share data from any computer and software. Besides of simplification of communication services, VAN can provide electronic data interchange (EDI) translation and security services in Customs. For instance, U.S. Customs Border and Protection (CBP) Service uses VAN system and offer various communication protocol possibilities (such as FTP, HTTPS, VPN) to users of their networks. Also, "*VANS offer in-network message translation services to convert data streams to conform with interface requirements of the many CBP Trade systems. VANS connecting to the CBP Trade systems enterprise infrastructure employ Cisco Internet or MPLS VPN with MQ Series Server to Server connectivity. CBP provides multiple resources for trade partners to submit a truck*

*manifest including a free portal and Electronic Data Interface (EDI) services using X.12, EDIFACT, and CUSCAR languages*"[22].

Today Customs is oriented to build Customer Oriented Architecture of ICT. Such Architecture begins with a real direction to a business services, supporting the Customs services to execute core regulatory and revenue collection functions of import, export, transit, trade facilitation and supply chain security. The latest ICT developments in Customs helped for exchange of information with trade partners, other in-country government agencies, and other Customs Administrations domestically and internationally.

The business approaches and performance mechanisms conducted by government and private sector has changed progressively in the last decades. People using of wide Internet access and ICT create a way for abuse or manipulation of available on market advanced technologies. Thus, the question arises of protecting ICT used by Customs. The information technology security risks in Customs has based on a risk management mechanism. Information Security Management System (ISMS) is regulated by ISO27001 standard. This standard support Customs manage the security of assets such as financial and monetary data, intellectual property, public health and safety, employee data, or information relied on to Customs by third parties. ICT security in Customs based on Security policy, which covers next: 1) Organization of information security; 2) Human Resource security; 3) Asset management; 4) Access Control; 5) Cryptography; 6) Physical an environmental security; 7) Operations security; 8) Communications security; 9) Contractor relationships; 10) Information security incident management; 11) Systems acquisition, development and maintenance; 12) Information security of business continuity management (BCM); 13) Compliance. Above listed areas in ICT Security Policy used by Customs and referred broadly to ISO 27002:2013 information technology security technique.

Full computerization of Customs activities will be required further legislative adjustments and development of IT infrastructure, and stability of Customs digitalization would be depended on certain level. It would depend from stability of Customs legislation and unification on Global level through adopting World Customs Organization standards, practices, recommendations and legal tools. Cultural resistance also should be avoided in development of advanced technologies in Customs, it should not be considered as threat for losing job places.

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[22] U.S. Customs and Border Protection Service. Home. Trade. Retrieved https://www.cbp.gov/trade/ace/truck-manifest/value-added-networks on 23 February 2020.

## 3.3. INDUSTRY 4.0 AND DISRUPTIVE TECHNOLOGIES, THEIR IMPACT ON CUSTOMS

Today, industrial environment is largely linked with using robots. Consider relations robots and humans at present we can say that mostly robots perform dirty, dangerous, or heavy-lifting tasks, however humans are employed to do delicate, cognitive, sophisticated work. It suggested that developing different types of robots are aimed to help humans to do their job in more safe, productive and precise way, but not replaced humans by robots. Today we have already practice when humans and robots work together, but in future with developing and accessibility of service robots this interaction will be highly increased.

The terminology Industry 4.0 came from German manufacturing. However, under this terminology should understand forth industrial revolution, with the previous three coming across mechanization, electricity, and IT. Industrial revolution in last two ages have passed mainly three stages. Initially it was Industry 2.0, it was focused on cost, producing identical products, applied on Economy of scale and mass production (started in 1900). The second was Industry 3.0, the eyes were aimed on quality, producing product with high quality and applied on Just in Time (JIT), Kanban, Pull Policy and Lean production mechanisms (started in 1970). The Industry 3.0 and Industry 2.0 was Policy-driven industries. However, the latest one is Industry 4.0, it focused on value, producing high valued products and has applied on Digital Technology, Industrial Internet of Things (IIoT), Big Data, Artificial Intelligence (AI), 3D Printing and developing innovative Smart Factory, Smart Supply Chain Management and Smart Products. Industry 4.0 is mainly Data-driven industry.

The seeing of Industry 4.0 is that after certain years, industrial enterprises will design world networks to link their equipment, plant, and storage facilities as cyber-physical systems, which will link and monitor each other smartly by exchanging data that starts actions. These cyber-physical systems will take the form of smart plants, smart machines and tools, smart storage facilities, and smart supply chains.

PWC Consulting Company provided definition Industry 4.0 in the following way "*The term Industry 4.0 stands for the fourth industrial revolution. Best understood as a new level of organization and control over the entire value chain of the lifecycle of products, it is geared towards increasingly individualized customer requirements. This cycle begins at the product idea, covers the order placement and extends through to development and manufacturing, all the way to the product delivery for the end customer, and concludes with recycling, encompassing all resultant services. The basis for the fourth industrial revolution is the availability of all relevant information in real time by connecting all instances involved in the value chain. The ability to derive the optimal value-added low at any time from the data is also*

*vital. The connection of people, things and systems creates dynamic, self-organizing, real-time optimized value-added connections within and across companies. These can be optimized according to different criteria such as costs, availability and consumption of resources*"[23]. The benefits for business of Industry 4.0 would be increased competitiveness; increased productivity and revenue; increased employment opportunities, strengthened human and IT resources management; optimization of production process; development of emerging technologies; delivery of quality customer service. Industry 4.0 have nine main blocks, they are following: "1) *Big Data and Analytics; 2) Autonomous Robots; 3) Simulation; 4) Horizontal and Vertical System Integration; 5) the Industrial Internet of Things (IIoT); 6) Cyber Security; 7) The Cloud; 8) Additive Manufacturing; 9) Augmented Reality*"[24].

In February 2020 Deloitte Consulting Company published completed survey on 2019 Deloitte and MAPI Smart Factory Study. According to this study twelve categories of use cases for advanced technology in existing processes and workstreams have been arranged in following order:

1. *"Quality sensing and detecting: real time equipment monitoring, visual analytics, in-line quality sensing.*
2. *Factory asset intelligence and performance management: Predictive maintenance, Augmented reality (AR) to assist maintenance personnel, sensor-enables asset monitoring.*
3. *Plant consumption and energy management: Sensor based waste, scrap, and utility consumption tracking, energy, water, waste optimization platform.*
4. *Advanced manufacturing: 3D Printing and Prototyping.*
5. *Engineering collaboration and digital twin: Fast prototyping, virtual reality production cell configuration, digital product modeling,*
6. *Robotic and cognitive process automation: Robotic process automation, machine learning, natural language processing, AI,*
7. *Command centers: Using data, analytics and visualization, and user-based insights.*
8. *Factory synchronization and real time asset tracking: Using active passive asset-tracking sensors to dynamically adjust schedule.*

[23] PWC. Industry 4.0 Opportunities and Challenges of Industrial Internet. Published by Pricewaterhouse Coopers Actiengesellschaft Wirtschaftsprüfungsgesellschaft (2014). Retrieved https://www.pwc.nl/en/assets/documents/pwc-industrie-4-0.pdf on 23 February 2020.
[24] World Customs Organization (WCO): Study report on Disruptive Technologies, June 2019. Publisher World Customs Organization, Belgium.

9. *Smart conveyance: Automated guided vehicles, automated conveyance to ensure continuous material flow.*

10. *Augmented efficiency and safety solutions: AR to support pick-by-vision and training; cobots and robotic arms in work cell; exoskeletons; digital signage and way finding; biometric health and safety monitoring.*

11. *Smart work-in-process warehousing solutions: AR picking, automated conveyance, real-time process visibility.*

12. *Risk-adjusted material requirements planning: Stochastic algorithms"*[25].

**Smart technologies are potential disruptors of manufacturing industry cost curves and gateways to new competitive space**



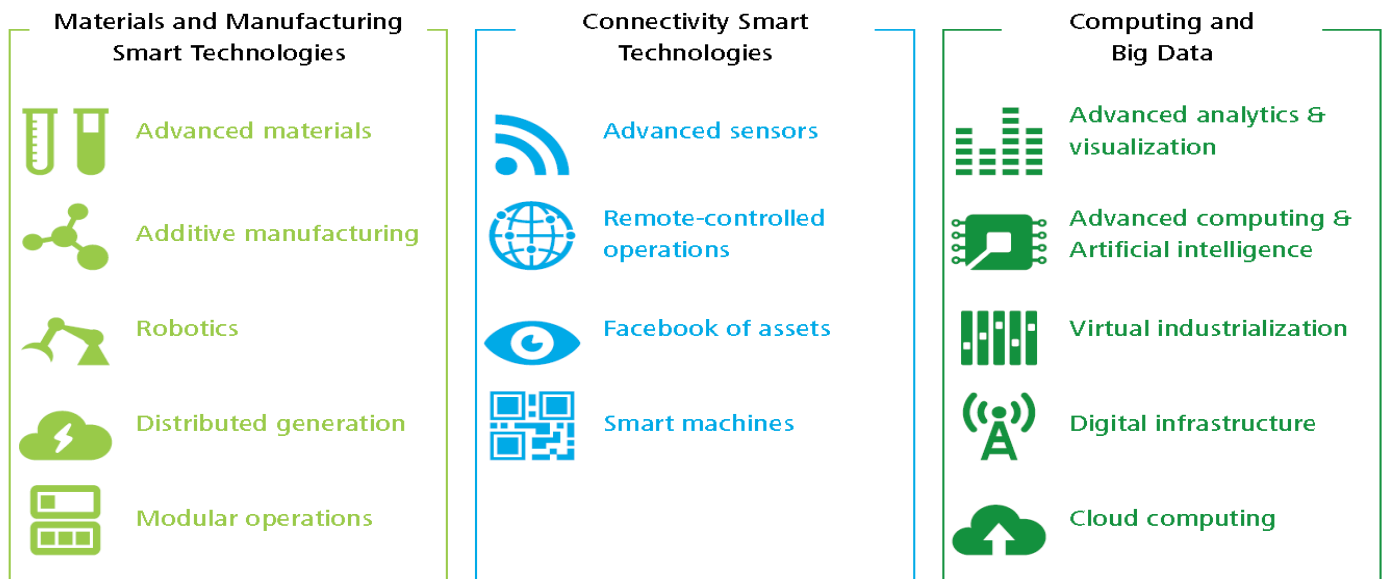| Materials and Manufacturing Smart Technologies | Connectivity Smart Technologies | Computing and Big Data |
|---|---|---|
| Advanced materials | Advanced sensors | Advanced analytics & visualization |
| Additive manufacturing | Remote-controlled operations | Advanced computing & Artificial intelligence |
| Robotics | Facebook of assets | Virtual industrialization |
| Distributed generation | Smart machines | Digital infrastructure |
| Modular operations | | Cloud computing |

Diagram 1: Diagram of Industry 4.0, Deloitte The Netherlands. Source Deloitte, www2.deloitte.com.

In another report published by World Economic Forum in June 2019 has shown the latest trend and direction of developing Emerging Technologies. Based on this 2019 report the Top 10 Emerging Technologies have been listed as following: "1) *Bioplastics for a Circular Economy; 2) Social Robots; 3) Tiny Lenses for Miniature Devices; 4) Disordered Proteins as Drug Targets; 5) Smarter Fertilizers Can Reduce Environmental Contamination; 6) Collaborative Telepresence; 7) Advanced Food Tracking and*

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[25] Paul Wellener, Steve Shepley, Ben Dollar, Stephen Laaper, Heather Ashton, and David Beckoff: *Capturing value through digital journey*. 2019 Deloitte and MAPI Smart Factory Study. Issue 27, January 2020. Retrieved https://documents.deloitte.com/insights/DeloitteReview26 on 24 February 2020.

*Packaging; 8) Safer Nuclear Reactors; 9) DNA Data Storage; 10) Utility-Scale Storage of Renewable Energy".*[26]

As industry has switched on to Smart Manufacturing process and the traditional Supply Chain processes transformed to Smart Supply Chain Management, the processes have become automated and digitalized.

Today we can announce existence of Customs 4.0, because Customs has been involved in all stages of previous Industrial revolutions and has connected to Industry 4.0 now, as one of the participant of the Smart Supply Chain Management processes, actively using innovative and emerging IIoT based technologies for trade facilitation, revenue collection and border customs control in respect of goods and passengers/travelers crossing the borders.



Picture 6: Guyana's Customs Inspector uses a mobile device to watch and trace stamped strong beverage. Source WCO, www.wcoomd.org.

Industrial Internet of Things (IIOT) has already applied in Customs. According to Alasdair Gilchrist "*the Industrial Internet provides a way to get better visibility and insight into the company's operations and assets through integration of machine sensors, middleware, software and backend cloud compute and storage systems*"[27]. Key technical drivers and business innovators of IIoT are following: 1) smart sensors;

[26] World Economic Forum (2019): Top 10 Emerging Technologies 2019. Report (June 2019). Retrieved http://www3.weforum.org/docs/WEF_Top_10_Emerging_Technologies_2019_Report.pdf on 24 February 2020.

[27] Alasdair Gilchrist (2016): *Industry 4.0. The Industrial Internet of Things*. Apress, Thailand.

2) Big Data and advanced analytics; 3) using drones and autonomous vehicles; 4) autonomous equipment; 5) Cloud computing and the Fog; 6) Cyber Physical Systems; 7) Wireless Technology; 8) IP Mobility; 9) Network Functionality Virtualization (NFV); 10) Smartphones; 11) Software Defined Networks (SDN); 12) Machine to Machine (M2M) and Artificial Intelligence; 13) Augmented Reality; 14) Additive manufacturing (3D Printing).

Customs at the frontline of the "Disruptive" or "Emerging Technologies" has been applying the technologies of Blockchain, IoT, Artificial (AI) and machine learning (ML), Biometrics, Drones, Virtual augmented and mixed reality, 3D Printing. IIoT technology so greatly benefitted from opportunities and techniques are used to Customs activities.

Customs Administrations has been using different types of sensors and related technologies associated with IIoT very actively in past years. They switched from using barcode technology (manual barcode scanners used for reading customs documentation during customs clearance of imported and exported goods) to use embedded RFID (Radio Frequency Identification) tags and the associated RFID readers. Radio Frequency Identification Technology has increased the capacity of the current customs system, and its great advantage is that information processing is quicker, simple and efficient. RFID technology helps priorities the building of smart customs (Customs 4.0). RFID ensures Customs Cargo Security, fast and simple customs clearance and application areas of these identification tools are E-seals for all type of containers (Cable, Bolt, Tie wrap), Windshield tags, Identity cards, Metal tags. For instance, German based software company DACOSY AG developed the DAKOSY system "ZAPP AIR" (the web and interface-based digital platform). In order to benefit from simplified exportation process and use advantages of ATLAS system (customs software for electronic customs clearance powered by German Customs), DACOSY created new extension by a mobile add-on which can be used in the new system *"AIR@Gate mobile"*[28]. DACOSY System based on active RFID allows the drivers of delivery vehicles with an on-board mobile device to automatically inform ATLAS system about the presentation of goods to Customs. This save time, money and provide efficient freight handling and customs clearance.

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[28] OHB Digital Services GmbH. RFID for Customs Clearance. Retrieved https://www.ohb-ds.de/en/economic-sectors/haulage-companies/205-rfid-for-customs-clearance on 26 February 2020.

RFID technology plays an essential role in modernization of customs management, specifically in the field of logistics-supply chain compliance. It ensures paperless customs clearance during movement of goods, speed and accuracy, fast confirmation, full tracking and operational effectiveness.



Picture 7: RFID Handheld Reader to read RFID E-Seal at Customs Station. Source Harcor, www.harcor.com.

The other smart solution done in Customs for using smart mobile application allowing travelers arriving



in country to securely submit passenger Customs Declarations electronically, thus avoiding traditional paper base declaration forms. The online declaration known as iDeclare, and novelty was implemented by Dubai Customs. It simplifies the Customs clearance process for travelers by allowing self-declaration of their mandatory declare commercial commodities, personal items or cash money either before or after land at the air terminal, ensure swiftly process, saving time and avoiding delay. The other feature of iDeclare application, it allows passengers to stay informed on the rules applying to commercial and non-commercial commodities, and Customs

officers anymore have to use efforts completing the passenger customs declarations on behalf of travelers. From other side iDeclare supports Dubai Customs better protect economy and ensure border security.

What is blockchain technology? In simplest way Blockchain could define as "*a reliable, difficult-to-hack record of transactions – and of who owns what. Blockchain is based on distributed ledger technology, which securely records information across peer-to-peer network*"[29]. Distributed ledgers apply separate computers (it is called nodes) to register, exchange and synchronize transactions. Blockchain builds information into blocks, which are linked together. Blockchain "*has the capability to transmit any kind of data swiftly and securely and, at the same time, make a record of that change, movement, or transaction available instantly, in a trusted and immutable manner, to the participants in a blockchain network, called validators or nodes*"[30]. The blockchain technology known as a Smart Contract as well. The Investopedia defines Smart Contract as *"a self-executing contract with the terms of the agreement between buyer and seller being directly written into lines of code. The code and the agreements contained therein exist across a distributed, decentralized blockchain network. The code controls the execution, and transactions are trackable, transparent and irreversible*"[31]. These self-executing contract with terms that are written down and performed automatically, allows the avoidance of mediators, which act as regulators of money and data. As we could see Blockchain that initially associated with Bitcoin mainly, has expanded far beyond the virtual cryptocurrency.

Figure 3: Blockchain (blocks that are linked using cryptography). Source World Economic Forum.

[29] SAP. Go beyond the hype of new technologies. What is Blockchain? Overview. Retrieved https://www.sap.com/hungary/insights/what-is-blockchain.html on 24 February 2020.
[30] World Customs Organization (WCO): Study report on Disruptive Technologies, June 2019. Publisher World Customs Organization, Belgium.
[31] Investopedia. Cryptocurrency. Blockchain. Retrieved https://www.investopedia.com/terms/s/smart-contracts.asp on 24 February 2020.

Blockchain really will change the way of humans transact, with further stronger redesigning how community, governments and business operate. Blockchain has capabilities to serve for sustainable growth and values creation, can potentially be used to addressed global challenges. According to World Economic Forum report "*Blockchain scaling – the value of blockchain is projected to exceed $176 billion by 2025, and $3.1 trillion by 2030*" [32].

The big feature of Blockchain technology is that ensures secure and trust environment between and within parties to perform business transactions and exchange data without middleman, at the same time promising data integrity and ensuring a full traceability of steps. However, today already known some challenges of Blockchain, they are in common likely: Technology barriers; Security risks; Legal and regulatory challenges; Interoperability risks; Energy consumption challenges.

In September 2015, in the survey report named Technology Tipping Points and Societal Impact published by the World Economic Forum, was done deep shift on the Six megatrends in software and services which expected to shape society. The Six Megatrends were promoted as: 1) People and the internet; 2)Computing, communications and storage everywhere; 3) The Internet of Things; 4) Artificial intelligence (AI) and big data; 5) The sharing economy and distributed trust; 6) The digitization of matter. As per World Economic Forum survey for Technology Tipping Points and Societal Impact *"the results show that a significant number of shifts were expected to occur in the early years of the next decade"[33]*. So, Governments and the Blockchain is expected to achieve by 2023, and the tipping points for Bitcoin and the Blockchain would be occurred by 2027.

Some words about, how technically operate Blockchain platform. The Blockchain applies on decentralized governance mechanisms, however, an operator who creates the rules for participants in the network, inter alia with regulators and state agencies. If the network detects something irregular, the relevant participant would be blocked out of the network. There is possibility to de-blocked and restore permit of the individual participant if an accident occurred has confirmed as occasionally. In case of fraud event, the operators would cooperate with the necessary state agencies to hold actions and fix breach.

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[32] World Economic Forum (2018). Fourth Industrial Revolution for the Earth Series. Building Block(chain)s for a Better Planet. In collaboration with PwC and Stanford Woods Institute for the Environment. Report (September 2018). Retrieved http://www3.weforum.org/docs/WEF_Building-Blockchains.pdf on February 2020.
[33] World Economic Forum (2015). Global Agenda Council on the Future of Software & Society. Deep Shift Technology Tipping Points and Societal Impact. Survey Report (September 2015). Retrieved http://www3.weforum.org/docs/WEF_GAC15_Technological_Tipping_Points_report_2015.pdf 25 February 2020.

This technology undoubtedly could be used in Customs and commercial environments, where validators/nodes in a transaction need to exchange data in secure and trust way. Blockchain cab be play a crucial role in identification of origin of goods, the other benefit is that trading related documentation does not need to physically travel with shipments or be exchanged between parties, zero paper documentation, eliminate trade fraud and exactly facilitate trade flow. At present some of the various platforms for reinforcing the supply chain with focus on logistics have been developed based on Blockchain technology by local/global government authorities and companies. Blockchain trade network is continued to expand and use by Customs as well. Some examples of public and private owned Blockchains where Customs Administrations involved are following: 1) TradeLens, jointly developed by Maersk and IBM; 2) Mercury II Digital ATA Carnet Project developed by The World Chambers Federation (WCF) of the International Chamber of Commerce (ICC); 3) CADENA, which allows data sharing on Authorized Economic Operators (AEO) for the implementation of Mutual Recognition Arrangements/Agreements between the Customs Administrations of Costa Rica, Mexico and Peru; 4) Ocean Shipping Blockchain Consortium led by SAMSUNG SDS Co., Korean Customs Export Declaration and Logistics Service led by SAMSUNG SDS Co. and KCNET Co. consortium; 5) Open Trade Blockchain (OTB) powered by Global eTrade Services Asia Pte Ltd (GeTS), and such on. All these platforms designed for provision business to business (B2B) and business to Government (B2G) and government to business (G2B) domain expertise.

For instance, GeTS trade platform has connection to "*61 Customs nodes across the the world, with more than 175000 connected parties and conducting 24.1 million transactions annually*"[34]. Another one "*TradeLens is processing over 13 million shipment events a week, with more than 120 event types (gate-in, vessel departure, and such on.) and handles over 100,000 shipping documents a week*"[35]. TradeLens blockchain based on Hyperledger Fabric architecture. Hyperledger Fabric is the modular blockchain framework standard for enterprise blockchain platforms.

Blockchain platform prepared by SAMSUNG SDS Co. is a good example of cooperation between government and private sector within Korea. Korean Customs Service (KCS) has led in acquiring new technologies. In 2018, KCS began execution the "Fourth Industrial Revolution and Smart Customs" initiative. The project was focused on delivering AI, the blockchain and big data to support Customs operations. In order to achieve this task KCS joined the joint public-private Ocean Shipping Blockchain Consortium operated by Samsung SDS

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[34] Global eTrade Services (GeTS) Company Profile. Retrieved https://globaletrade.services/gets-profile on 25 February 2020.
[35] TradeLens Company Platform. Retrieved https://www.tradelens.com/platform on 25 February 2020.

Co., which brings together 41 entities, from government and business sectors and supported sharing logistics documents such as Bill of Lading and Letters of Credit. This positive experience was followed by decision to build a new project with participation of KCS, Samsung SDS Co. and 48 relevant government offices and companies to create the blockchain-based export customs logistics service business in order to deeply integrate the blockchain into existing Korean Customs systems. In 2018 Samsung SDS Co. was selected as blockchain-based customs clearance logistics service operator by KCS. The new blockchain platform was built based on NEXLEDGER Universal Architecture. The blockchain architecture owned by Samsung SDS Co. has "*real-time mass transaction processing and smart contract capabilities, and a management monitoring system to different government offices and industries such as finance, manufacturing, logistics*"[36].
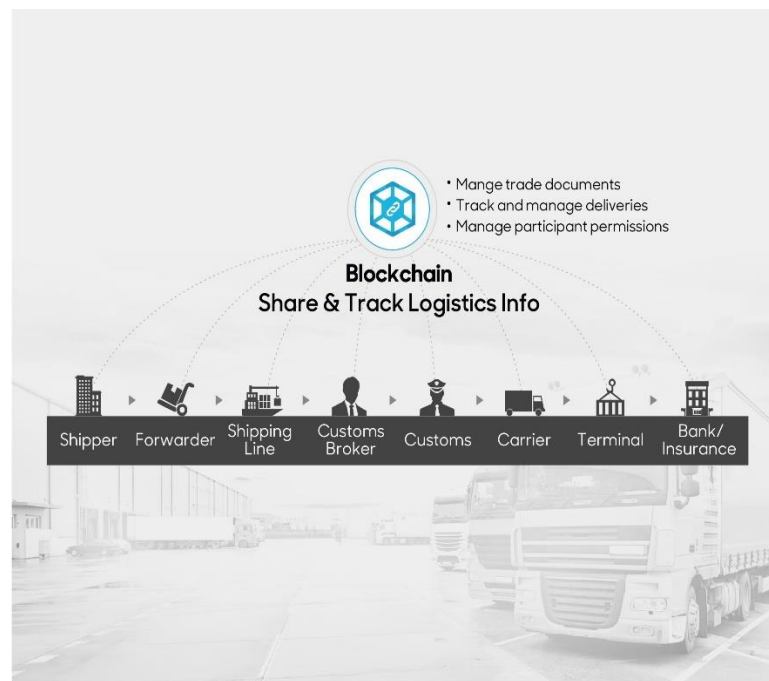


Figure 4: Blockchain. Share and Track Logistics Info. Source Samsung SDS Co.

This new platform has over 60 blockchain nodes and "*participants can be shared 22 types of different documents in real time, such as commercial invoice, packing list, the bill of lading, the booking request or confirmation, and the export customs declaration*"[37].

[36] Samsung SDS Co. Media Reports (September 2018). Samsung SDS to be World's First to Apply Blockchain Tech to Export Customs Logistics Service. Media Reports (September 2018). Retrieved https://www.samsungsds.com/global/en/about/news/blockchain-tech-for-customs-logistics-service.html on 26 February 2020.
[37] Tae Il Kang (2019): Korea pilots blockchain technology as it prepares for the future. WCO News. Issue 88, February 2019. Publisher World Customs Organisation. Retrieved https://mag.wcoomd.org/magazine/wco-news-88/korea-pilots-blockchain-technology-as-it-prepares-for-the-future/ on 26 February 2020.

Figure 5: Blockchain. Digital Identity process. Source Samsung SDS Co.



Figure 6: Blockchain. Digital Payment process. Source Samsung SDS Co.

As the next initiative done by Korean Customs Service and Samsung SDS Co. was connection different blockchain platforms. In September 2018 Samsung SDS Co. has involved in project with ABN AMRO, Port of Rotterdam for launching container logistics blockchain, based on DELIVER platform. In July 2019 *"first paperless, instantly financed and fully door-to-door intermodal tracked container made its way from Korea to*

*the Netherlands on Blockchain-based platform DELIVER"*[38], which confirmed the interoperability of networks using different blockchain technologies. DELIVER keeps functions such of notarization, double payment prevention, and asset transfer. As said Samsung SDS Co. representative "*The Customs Clearance Blockchain System at the Korea Customs Service is based on Hyperledger Fabric, while Rotterdam Port in the Netherlands is using the Etherium Platform*"[39].

The other example how cutting technology can make impact on Customs is CADENA. CADENA architecture is based on blockchain technology. In 2005, World Customs Organization introduced a framework to identify secured and trusted entities, known as the Authorized Economic Operator (AEO). At present 84 operational AEO programs are certified to meet AEO standards, and 74 bi-lateral and 4 plurilateral/regional MRAs concluded. In order to ensure the live work process, Customs administrations are recommended to exchange their lists of AEOs with their partner organizations. This exchange of completed lists is called as Mutual Recognition Arrangements/Agreements (MRAs). The AEO operators usually considers as trusted economic operators and can be benefitted from a reduction of physical and documentary Customs inspections. The blockchain solution with focus on management for the AEO certification process under MRAs between Mexico, Peru and Costa Rica was implemented in 2018, in order to improve and secure data exchange process. CADENA was developed by Customs Administrations of above noted countries with supports of Inter-American Development Bank (IADB) and Microsoft. A blockchain solution brings exact advantages for management of AEO certification mechanism and realization of MRAs, allowing to register and share transactions, share the status of an AEO certificate in real time, keep transactions secure and control an immutable audit trail, ensure traceability and confidentiality of the data. It also provides automation for validation of AEOs under and MRA, using smart contract.

All these efforts of different stakeholders, including Customs Administrations are step forward for further development different kind of blockchain platforms in the supply chain management with further interconnection between them. The common of these platforms that they are secured, transparent, permissioned, open and neutral, robust supply chain platforms with visibility, standards and opportunity for interoperability. The Ecosystem members of these blockchains are AEOs, consignors, expeditors, seaports and other terminals, ocean freight operators, intermodal carriers, customs agents, insurance company, bank, government authorities

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[38] ABN AMRO Company. News Articles. ABN AMRO, Port of Rotterdam and Samsung SDS prove that blockchain technology works for Deliver (July 2019). Retrieved https://www.abnamro.com/en/newsroom/newsarticles/2019/abn-amro-port-of-rotterdam-and-samsung-sds-prove-that-blockchain-technology-works-for-deliver.html on 25 February 2020.

[39] Michael Herh: Samsung SDS Connects Different Blockchain Platforms with 'Deliver' Platform (March 2019). Business Korea. Business News Portal. Retrieved http://www.businesskorea.co.kr/news/articleView.html?idxno=30001 on February 2020.

(for instance, Customs). These platforms provide values for all the entities participated in supply chain with the digital tools to share data and collaborate in trusted, secure and immutable way. There is possibility for registration of trade and export related documents (such as Bill of Lading, Certificate of Origin, Commercial Invoice, Letter of Credit, Insurance Documents, Inspection Certificate, Packing Lists, and such on) and validation of trade documents in country of destination. Engagement in Blockchain is smarter solution to be involved in trade and be one of the actors of process automation. Blockchain facilitate trade businesses through end-to-end connectivity, accessibility and regulatory compliance. For Customs Administrations Blockchain valuable from effective control, increasing efficiency, transparency, preventing from forgery and falsification of documentation. These platforms would be led to stronger trade facilitation and compliance, helping to bridge the trust. Blockchain provides reliable and fast supply chain data exchange in digital environment.

### 3.3.1. GLOBAL TRAVEL ASSESSMENT SYSTEM (GTAS)

GTAS is a free of charge, an integrated web application that developed in Java and uses open source software components and platforms. It is designated for improving Global Security by using international aviation standard Advance Passenger Information (API) to screen enter and leave commercial air travelers and crewmembers. GTAS was projected by the U.S. Customs and Border Protection (CBP) agency under auspice of World Customs Organization.

The goal of creating GTAS was support the global counterterrorism and increase level of travel security for all people. The international legal foundation was United Nations Security Council Resolution 2178 (2014) on Foreign Terrorist Fighter (FTF), where the Council reconfirmed that all Governments shall prevent the movement of terrorists or terrorist groups by effective border controls. This application constructed for use primarily by any government organization responsible for customs enforcement, border management, immigration, national security, or even tourism. This application is an advance passenger data risk assessment system that allows advance passenger information (API) and passenger name record (PNR) data to be collected and analyzed by Customs Administrations from moment of buying passenger air ticket. GTAS provides more fast and efficient process for collecting and analyzing passenger data (such as Biographic/Travel Document, Flight and Carrier), support legitimate travel, identify possible terrorist, prevent smuggling, missing persons, overstayed visas, automatically screens all passengers in real time and facilitate passenger flows.
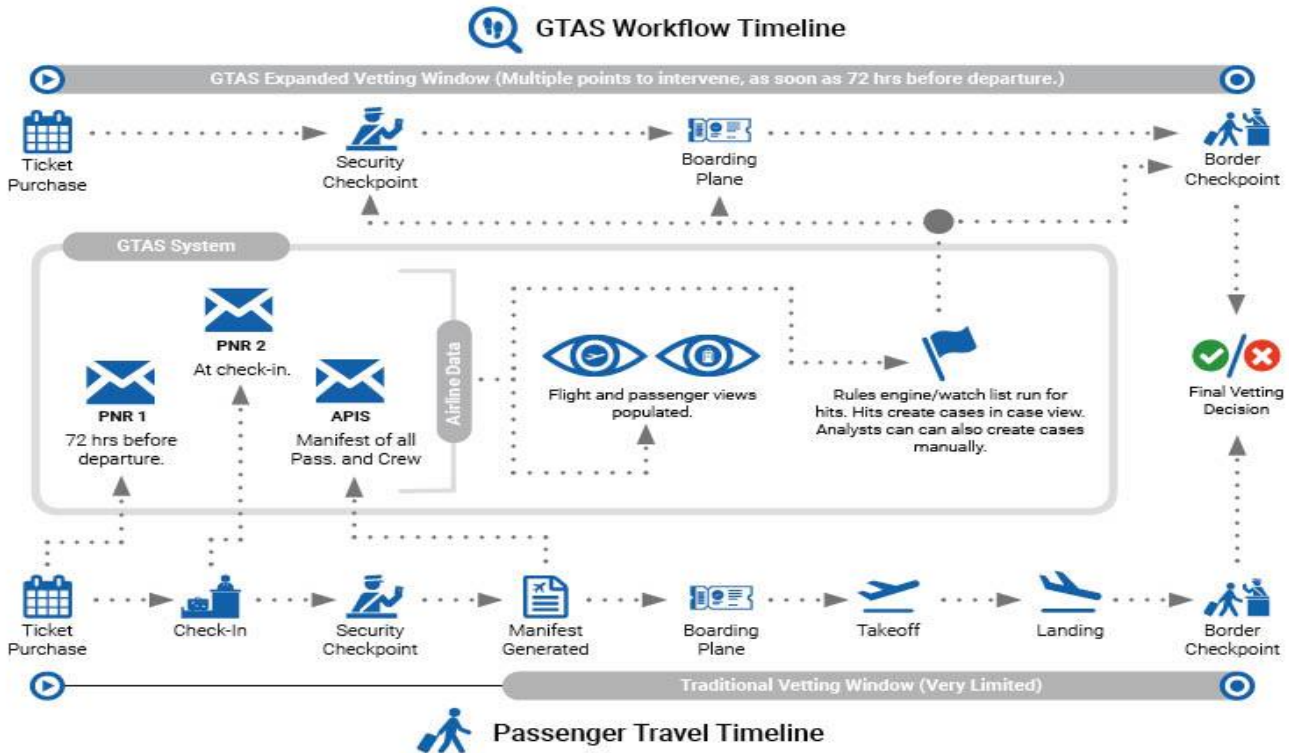
## GTAS Integrated Workflow

Figure 7: It shows the GTAS Integrated Workflow system. Source World Customs Organisation-GTAS.

It also enables for real-time passenger document validation against databases and enables national government officials to make Board/No-Board decisions in real time, helps for the reduction of repetitive works of border management officers through the applying of emerging technology and automated means.

Installing GTAS an integrated automated system Customs can independently perform vetting activities, conduct independent risk rules as well as targets based on API and/or PNR data to support in stronger border security and customs risk management.

GTAS system has already progressed by U.S CBP Agency (2016), Maldives Customs Service (2017), Pakistan Federal Bureau of Revenue (2019), Uganda Revenue Authority (2020), and has trend for growing of implementation from other Customs Administrations.

## 3.3.2. INTERNATIONAL CUSTOMS TRANSIT AND GUARANTEE SYSTEM (eTIR DIGITAL SYSTEM)

*"'TIR' (Transports Internationaux Routiers or International Road Transport) is an international transit system based on a United Nations Customs Convention on the international Transport of Goods under cover of TIR*

*Carnets, implemented at international level in Public-Private Partnership"*[40]. The TIR Customs transit system was developed after the Second World War under the umbrella of United Nations Economic Commission for Europe (UNECE). Legal foundation was put in 1949, when some European countries concluded an agreement on the TIR transit system. Due the popularity and success of this transit system the first TIR Convention was adopted in 1959 by the Inland Transport Committee. The last time Convention was revised in 1975 and since it has known as revised TIR Convention 1975 (entered into force in 1976). Totally TIR Convention has adopted eleven Annexes, the last was done in 2018. According to IRU organization *"TIR Convention has more than 70 Contracting Parties"*[41]. It benefits global trade facilitation and secure movement of goods in transit customs-sealed vehicles and shipment containers, reducing customs control mechanisms by Customs Administrations at border. Using TIR Carnets (international customs document) and the international guarantee to the transport operator for a single TIR Transport, secured that customs control arrangement done in the country of departure should not be occurred again by the countries of transit and destination. In order to ensure paperless Computerization of the TIR Procedure the Contracting parties to the TIR Convention launched the "eTIR project" to fully computerize the TIR procedure (2003). The goal of this initiative was ensuring integrated supply chain management, paperless, data exchange in secure way, promoting better risk assessment management, and reducing the risk of fraud. From this initiative benefitted all stakeholders, customs administration, national and international transport associations, and others. Some facts about TIR transit system: *"over 34,000 transport and logistics companies use TIR to quickly and reliably move goods across international borders, 1.2 million TIR transports in 2016 and an international guarantee covers all customs duties and taxes at risk, with a maximum protection of EUR 100,000.00 per transport operation"*[42]. The first pilot eTIR project was successfully implemented between Turkey and Islamic Republic of Iran in 2017, and later the second one was completed between Turkey and Georgia. In June 2019 Azerbaijan and Islamic Republic of Iran commenced Digital eTIR transport mechanism ensuring paperless, digital eTIR application in a real transit environment. All above pilot projects have shown proof of concept for Customs-to-Customs electronic exchange of data for eTIR transit purposes in single integrated digital environment.

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[40] FICCI. TIR Carnet. Retrieved http://ficci.in/sector-details.asp?sectorid=44 on 26 February 2020.

[41] International Road Transport Union (IRU). TIR: Global. Seamless. Certain. Retrieved https://www.iru.org/system/files/IRU-brochure-TIR-global-seamless-certain-EN.pdf on 26 February 2020.

[42] Ibid.

Map 2: The eTIR pilot project between the Iranian and Turkish Customs authorities, two transport operators, and the two countries' respective TIR Guaranteeing Associations. Source World Customs Organization (2016).

All participants in the eTIR project installed reliable, secure software applications and web services for the exchange of data. National transport associations use the 'TIR Association Portal' to issue electronic guarantees to transport operators, and transport operators use the 'TIR Holder Portal' to order e-guarantees and deliver pre-declarations to Customs Administrations. It is developed by IRU and known as TIR Pre-Declarations -TIR-EPD, allows to send advance shipment information and interchange statement with multiple Customs Administrations across a TIR transport. TIR data is processed from Customs Office Information and Communication Technology (ICT) systems to the IRU, and instantly recorded to the eTIR international system hosted by United Nations Economic Commission for Europe (UNECE). Both the IRU and UNECE platforms provide trustful digital services to Customs administrations to confirm the validity of an issued e-guarantee, as well as get all information for a means of transport under an e-guarantee. The validity and the status of each TIR guarantee at any moment in real time can be traced through the Real-Time SafeTIR system (RTS) developed by IRU. This tools also provides data to Customs Administration about the user and the name of the TIR guarantee issuing organization, customs messages already exchanged by other Customs across the transport. It is trusted risk management mechanisms and automation processes in respect of TIR operations.

The eTIR was constructed based on terms of World Customs Organization (WCO) SAFE Framework (Framework of Standards to Secure and Facilitate Global Trade) and WCO Data Model. The eTIR is a gate to real-time data access with delivery of advance cargo information (ACI) which potentially benefited to all

involved parties. It minimizes the risk of forgery and fraud, increase security, expediting customs clearance, facilitate global trade, cuts border waiting time, and minimizing costs, provides direct economic benefits and streamline transit procedures.

### 3.3.3. ACXIS-AUTOMATED COMPARISON OF X-RAY IMAGES FOR CARGO SCANNING

Customs Administrations are responsible for the revenue collection and regulatory compliance, security of movements of goods transported by different mode of transport (air, sea, land and railway) through customs borders and combat contraband and transnational crime. As part of customs control measures in order to confirm whether the transported goods in comply with the transportation documentation and import/export or transit declaration, to predict and detect illegal items, X-ray imaging inspection of containers and vehicles are used at Customs border points. ACXIS is a European research project funded by European Union. This project focused on "*research in Automated Comparison of X-Ray Images for cargo Scanning with reference material (use of past images in an automated environment) to identify suspicious deviations and any irregularities*"[43]. The main objective of this research and development project is to grow the efficiency and effectiveness, strengthen the customs inspection measures of shipments at Customs Offices using X-Ray technology. The project performed building of independent reference databank for different X-ray images of both legal and illicit cargo and integrated all past images into this databank, mapped ways of unification of X-ray images completed by various inspection cargo scanning systems, developed automated recognition methods in respect of illicit cargo.

The ACXIS research project executes together with seven partners from research and industrial sectors (such as SH Smiths Detection, CASRA APSS Software & Services AG, CEA French Alternative Energies and Atomic Energy Commission, and such on), two participants are Customs Administrations.

During the project inspection procedures are observed to identify risks, formulate database of illegal goods and things, other items, and prioritize detections models. As solution, there was proposed an integrated proposal that ensure automation, data exchange between Customs Authorities, and computer-based training modules for customs inspector.

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[43] ACXIS Project. Home. Retrieved https://www.acxis.eu/index.html on 27 February 2020.

Picture 8: Targeted controls, Customs Officer from the Image Analysis Office look at a scanned image while their workmates conduct a physical examination of the same suspicious cargo. Singapore Customs. Source: World Customs Organization (2019).

The conducted proposal includes use Automated Target Recognition (ATR) functions analyze the X-ray image after a scan is completed to discover specific, excise merchandise and prohibited items such as tobacco (cigarettes), narcotics and arms in the truck or cargo container. ATR functions discover suspicious items and send to the Customs Inspector data for further examination. As an option, ATR has capability to transform X-ray image to a producer independent format via geometrical and spectral corrections and keep into database together with the user comments and other appropriate data. There is possibility to exchange data with similar systems to another stations. This mechanism facilitates data exchange between Customs Authorities. The database included more 38,331 X-ray scan images of container and trailer combinations about legal and illicit goods and items. These scans were collected using HCVS and CAB 2000 scanners from Smiths Detection. Using machine learning technology, the ATR functions are applied on these images. For better implementation of X-ray images by Customs operators, a computer-based training software is developed that allows simulates these new inspection mechanisms. Through data exchange of X-ray images Customs operators can learn and develop themselves. During the project for Reference Database below techniques were performed: Image Selection by Risk Analysis, Analysis X-ray Image Standardization, Projecting 3D Models, Blending Images of Illicit Items into Containers. In respect of Automated Target Recognition (ATR) functions the

following steps implemented: Image Denoising, Cigarettes Detection, Detection of Illicit Items, Additional Tooling. Advantages of ACXIS research project are strong expertise of partners which brings together innovations, universality and automation.

Innovations: "*New image and signal processing algorithms available to amend artifacts from X-ray scatter and imperfect scanner systems as well as to improve the rendering of the cargo images simplifying the detection of illegal objects"*[44].

Universality: "*Manufacturer independent reference database available with X-ray images of illegal and legitimate cargo"*[45].

Automation: "*Highly reliable software developed for automated identification of known illegal objects ("Historic Images") as add-ons for existing cargo scanning systems"*[46].

### 3.3.4. C-BORD - EFFECTIVE CONTAINER INSPECTION AT BORDer CONTROL POINTS

The big volume of contraband activities related to legally produced goods but misdeclared (for instance cigarettes, alcohol, industrial and IT items, food, and such on). Contraband activities also related to: 1) illegal goods (the origin or producer of goods are unknown); 2) drugs trafficking; 3) transportation of dangerous items (weapons) and illicit substances (explosives, nuclear material, chemical and biological warfare agents, radioactively contaminated goods); 5) illegal immigration and human being trafficking; 6) wildlife and the live plants. All above listed smuggling activities are possible carried out by using cargo containers.

Effective container inspection at sea and land border control points are part of initiatives of Horizon 2020 research and innovation program. The project conducted between June 2015 - November 2018, and European Union has already contributed EUR 11, 826, 452.50. A broad Consortium of 18 partners from nine countries are participated in the project. The prime end users of the result of this program are Customs Administrations member states of European Union due Customs wants to know what is inside of the container. The technologically providers of the program is global leader companies in manufacturing of radiation and detection equipment and power nuclear tools such Smith Detection, Symetrica CAEN – Costruzioni Apparecchiature Elettroniche S.p.A., as well as research and development organizations such as the University of Manchester, the Hochschule Bonn-Rhein-Sieg (University of Applied

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[44] ACXIS Project. Home. Retrieved https://www.acxis.eu/index.html on 27 February 2020.
[45] Ibid.
[46] Ibid.

Sciences (H-BRS)) Ecole Breguet, ESIEE Paris an Engineering School, The French Alternative Energies and Atomic Energy Commission (CEA), and others.
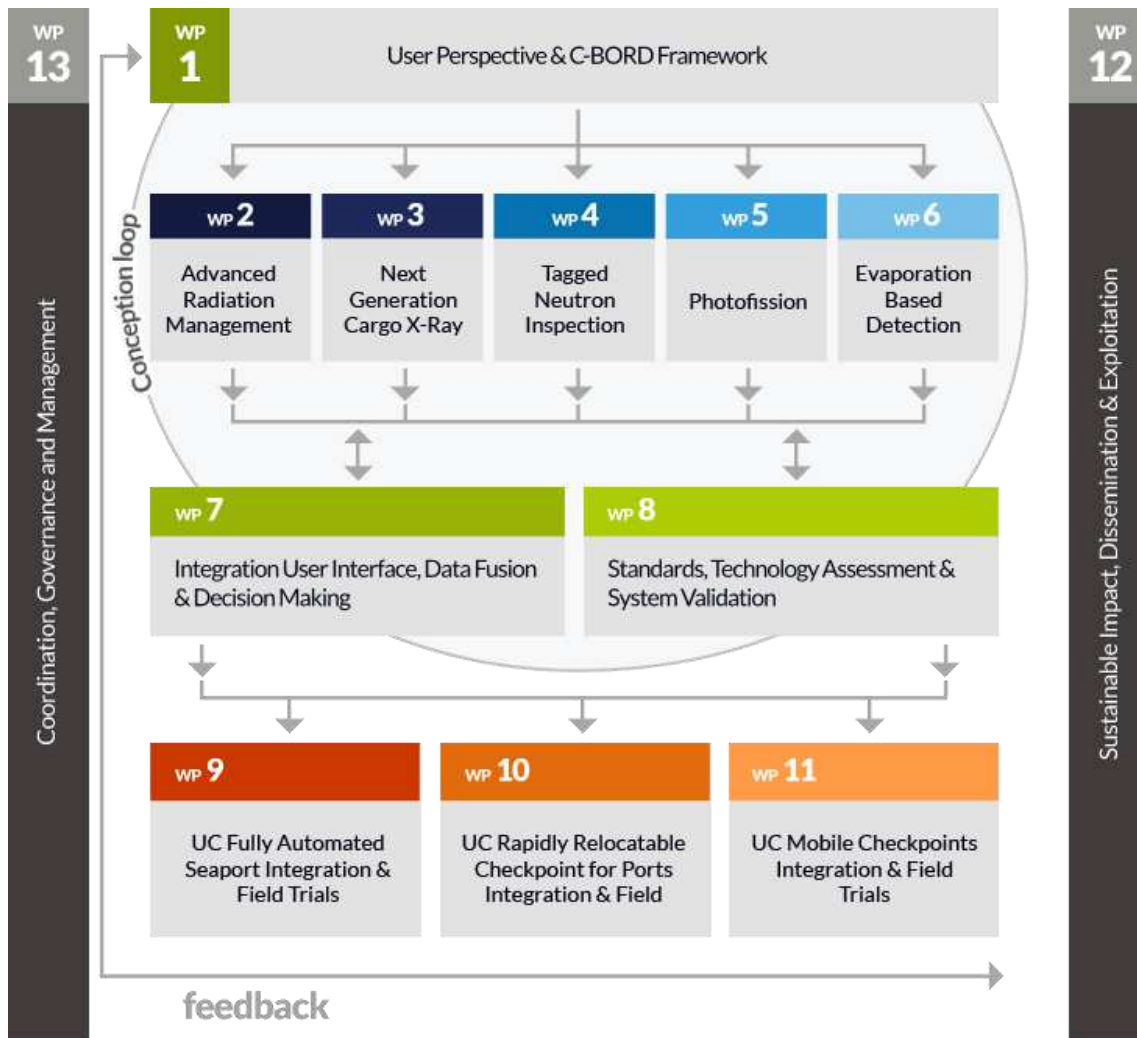
Project overview

Diagram 2: A diagram shows general project overview. Source C-BORD project website.

The strategic goal of the program was improving a safety chain for container inspection at sea and land border control points. C-BORD will increase detection and prohibition of illegal and dangerous items in cargo containerized space and bring new capabilities for increasing effectiveness and efficiency of operational requirements of Customs Administrations through lower false negative and false positive alarm levels; increased throughput of containers per time unit; reduced need for costly, labour consuming, time-wasting and dangerous physical container inspections.

Efficient and comprehensive cost-effective NII (Non-Intrusive Inspection) of containerized freight is highly important to global trade security, health and safety of society due single NII inspection technology is not able to cover all potential threats in containerized chain. Thus, C-BORD developed five new cutting-edge NII technologies such as: 1) Advanced Radiation Management; 2) Tagged Neutron Inspection; 3) Photo-fission; 4) Sniffer and 5) Next Generation Cargo X-ray. Combination of advanced five NII technologies will guarantee reliable and more depth inspections inside of a large volume shipment container through generation of data by the five technologies in a united Graphic User Interface for customs decision-making. C-BORD application areas are ports and hinterland environments. Introduced toolboxes such as: 1) Advanced Radiation Management, 2) Next Generation Cargo X-ray, 3) Evaporation Based Detection, 4) Rapidly Relocatable Tagged Neutron Inspection System (RRTNIS) were tested in three live field. The tests were completed in border control points at Rotterdam port, Gdansk port and Hungarian land border under various conditions and operational environment. These conditions and operational environment were accessed under three cases: 1) in Fully Automated Seaport Integration with fixed installations in Rotterdam port; 2) in Rapidly Relocatable Checkpoint for Ports Integration in Gdansk port; and 3) Mobile Checkpoint Integration at Hungarian land border.

Advanced Radiation Management are combination and governance of processes of radiation detection, classification and IR; fixed, relocatable and mobile solutions, resilience to masked nuclear threats.

Next Generation Cargo X-ray have capabilities for Global X-ray improvements; chemical separation of overlapping objects and chemical discrimination for low dose systems; improved material classification in the organic diapason.

Rapidly Relocatable Tagged Neutron Inspection System (RRTNIS) developed for sensitive detection of explosives, illicit drugs and chemical agents, identification of elemental chemical composition.
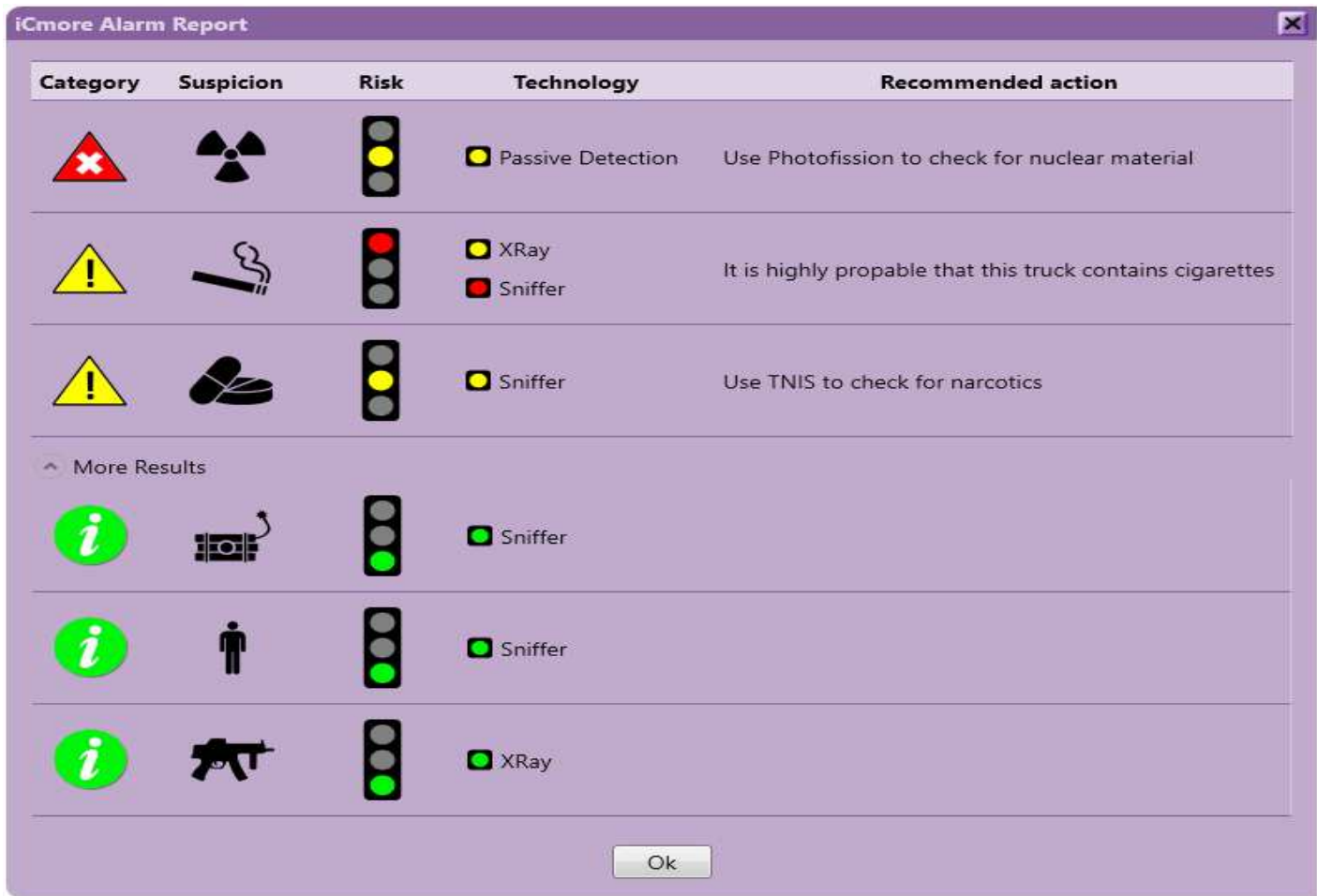
| iCmore Alarm Report | | | | |
|---|---|---|---|---|
| **Category** | **Suspicion** | **Risk** | **Technology** | **Recommended action** |
| ⚠❌ | ☢ | 🟡 | 🟡 Passive Detection | Use Photofission to check for nuclear material |
| ⚠ | 🚬 | 🔴 | 🟡 XRay  🔴 Sniffer | It is highly propable that this truck contains cigarettes |
| ⚠ | 💊 | 🟡 | 🟡 Sniffer | Use TNIS to check for narcotics |
| ⌃ More Results | | | | |
| ℹ | 💣 | 🟢 | 🟢 Sniffer | |
| ℹ | 🧍 | 🟢 | 🟢 Sniffer | |
| ℹ | 🔫 | 🟢 | 🟢 XRay | |

Ok

Picture 9: The Screen captures from Daisy, an analysis software tool from Smiths Detection. A single graphic user interface for customs decision-making. Source Smith Detection via CEA webpage, www.cea.fr/english.

This relocatable inspection system reduced in size and costs and has been redeveloped in terms of complexity. The RRTNIS *"will be a second-line system to be used on sealed containers, allowing to detection of explosives, illicit drugs and chemical agents in a suspect voxel"*[47].

Evaporation based detection system of illicit drugs and volatile chemicals in shipment container can give warning of hazard or smuggling. It is a robust, highly sensory (equipped with biosensor) and with capability of machine learning to increase level of choice. It considers as an additional to X-ray imaging.

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[47] The French Alternative Energies and Atomic Energy Commission (CEA). News. C-BORD helping customs to inspect containerized freight. Published on 19 June 2017. Retrieved http://www.cea.fr/english/Pages/News/C-BORD-helping-customs-to-inspect-containerised-freight.aspx on 27 February 2020.
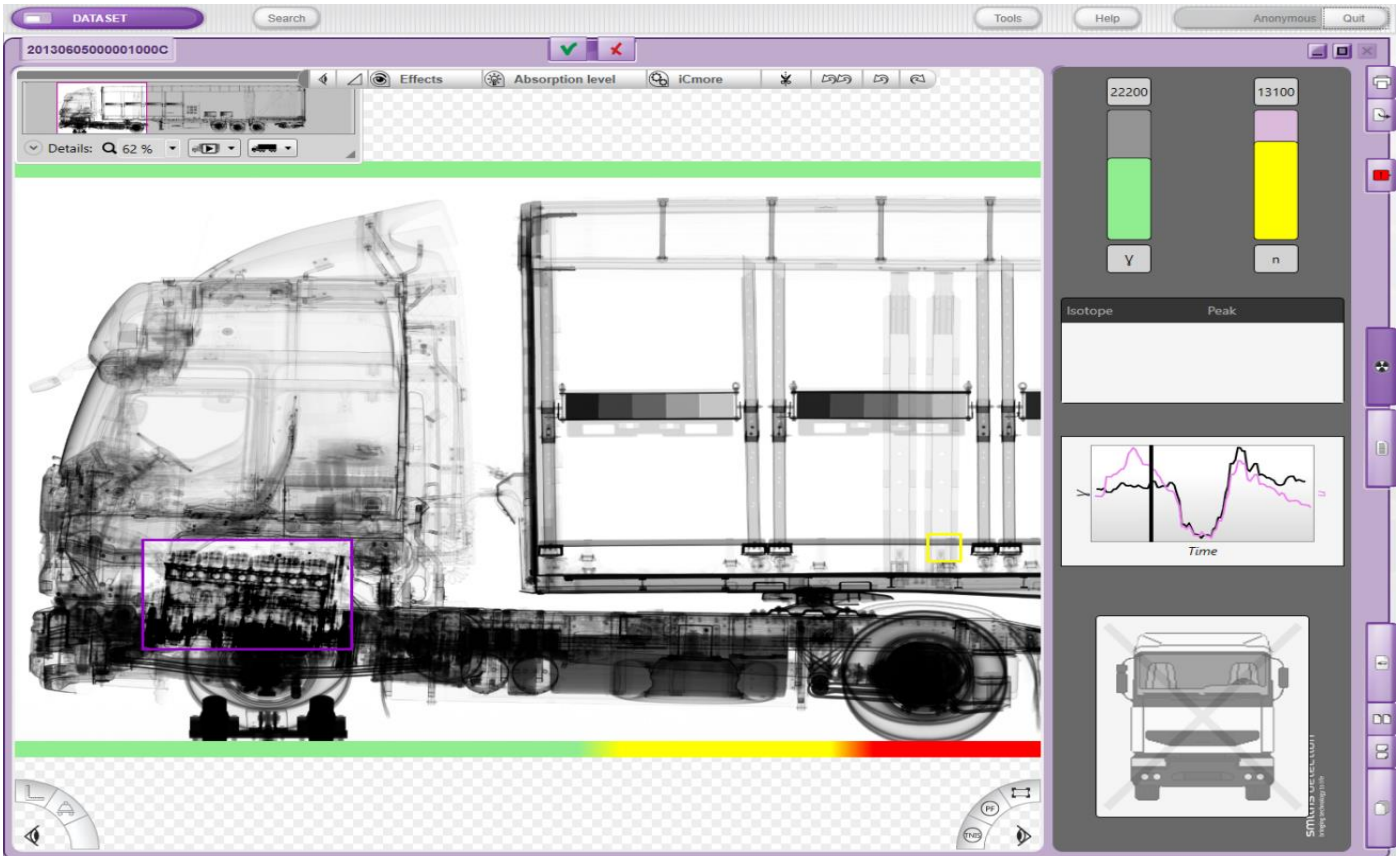
Picture 10: Screen captures from DaiSy, an analysis software tool from Smiths Detection. Next Generation Cargo X-ray. Source Smiths Detection via CEA, www.cea.fr/english.
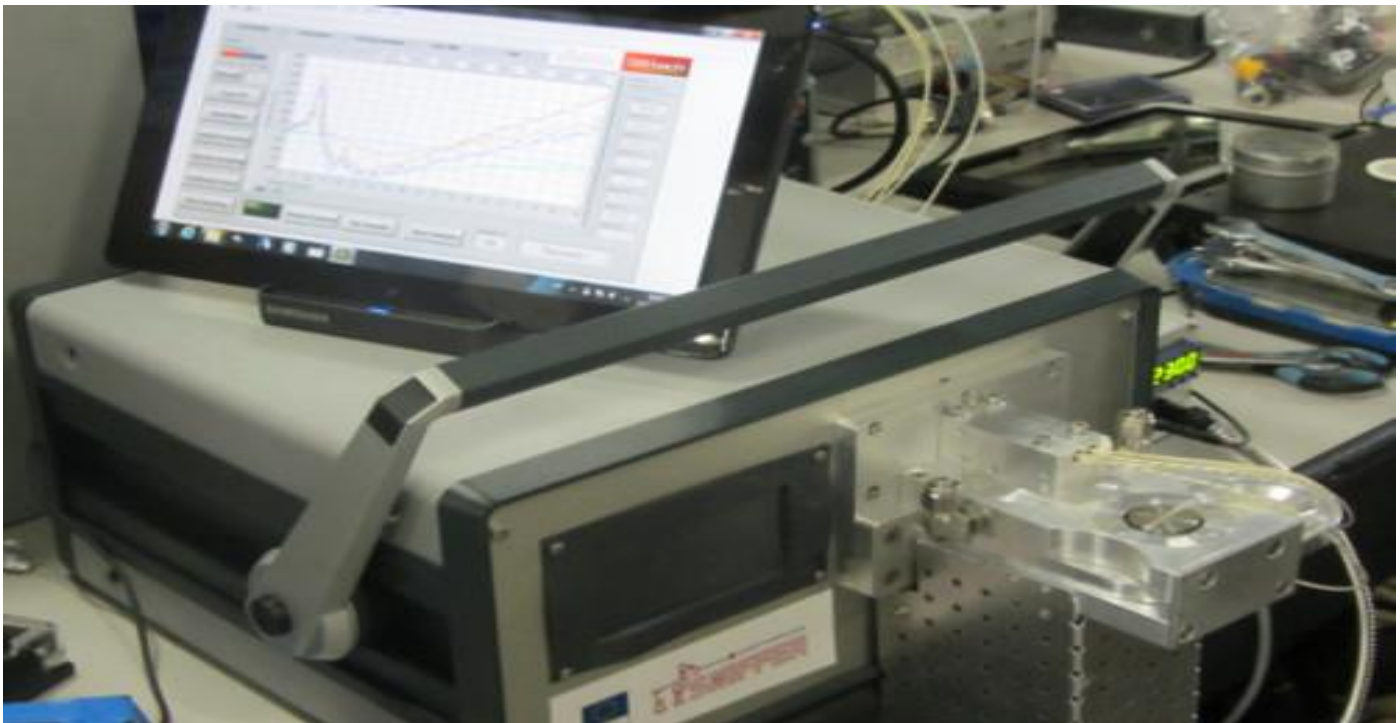


Picture 11: Evaporation based detector, as complimentary to X-ray imaging. Source C-BORD project webpage.
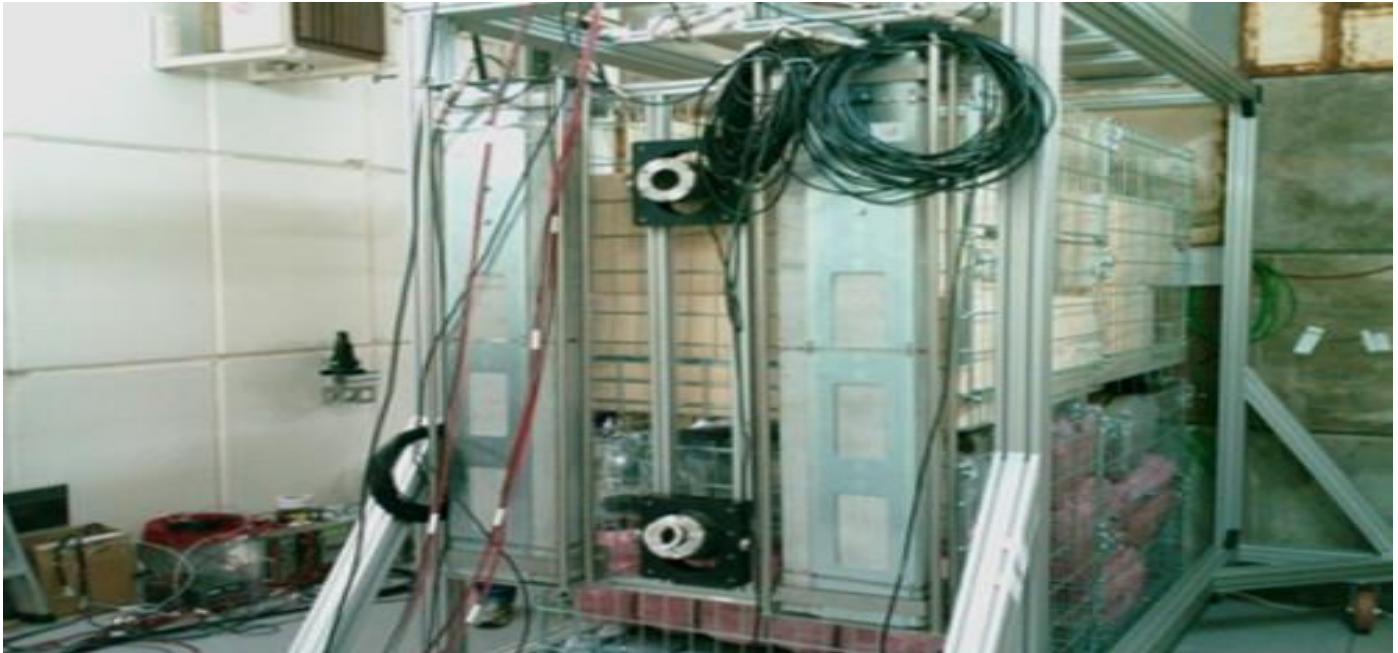
Picture 12: Test process and validation in first EU photo-fission port installation. Source C-BORD project webpage.

The photo-fission technology is targeted on direct detection of SNM (Special Nuclear Material), specifically uranium and plutonium isotopes. SNM detection is an important issue for security purpose in any country. It enables for inspection of the shipment container without physical opening it, which is a labour-consuming, and really very dangerous process for health and safety of Customs Officers. This equipment is an additional to X-ray imaging by allowing detection chemical data instead of the object's outline, thus raising the recognition capacity of the scanning system. There is existance strong connection between high-energy imaging and photo-fission technology.

How Customs can be benefitted really from implementation of C-BORD achievements? Using big arsenal of technologies at sea and land border gates for inspection of arrived cargo containers and vehicles, Customs would be easy get remote access inside of containers and their contents. After arriving truck, it will be inspected a part or fully based on the five new NII detection technologies, in depend on circumstances suspicious, available cargo information and route. Using risk assessment technique in respect of cargo detection techniques will be activated on inspection line in customs control process. Both passive and active elements of detection will be implemented. For instance, using sensors for analysis of the air from the cargo container or truck, using passive nuclear material detection, which determines radiation background near the cargo, new generation X-ray which allows visualise and see 'layer by layer' content of cargo containers and truck, and other Non-Intrusive Inspection technologies. Application of C-BORD techniques requires sufficiently financial investments from Customs Administrations in order

to develop cutting edge detection facilities at gates. Even after testing and field trials C-BORD results are over expectation, but probably is not absolute way of protection. However, C-BORD solutions is great achievement for better security of homeland, sea and land borders from any illicit activities connected with movement of cargo containers and in trucks.

### 3.3.5. ASYCUDA – AUTOMATED SYSTEM FOR CUSTOMS DATA

United Nations adopted the universal 2030 Agenda on Sustainable Development which includes seventeen goals and one hundred sixty nines targets. This agenda covers majority important areas for humanity and people such as: 1) No Poverty; 2) Zero Hunger; 3) Good Health and Well-being; 4) Quality Education; 5) Gender Equality; 6) Clean Water and Sanitation; 7) Affordable and Clean Energy; 8) Decent Work and Economic Growth; 9) Industry, Innovation and Infrastructure; 10) Reduced Inequality; 11) Sustainable Cities and Communities; 12) Responsible Consumption and Production; 13) Climate Action; 14) Life Below Water; 15) Life on Land; 16) Peace and Justice Strong Institutions; 17) Partnerships to achieve the Goal. National Customs Administrations within their area of activities are responsible for delivering this Agenda as well.

Conducting an efficient and effective Customs Management is critically important to the grow of any economy. One of the key functions of Customs Administrations are revenue collection, so they benefit to national economy grow. They also support the Government to realize national and foreign trade (through measures of tariff and nontariff regulation) policy, provides statistical data on foreign trade, promote trade facilitation, fight against contraband of illegal goods and fraud in trade chain. In order to be successful in realization of these responsibilities and tasks National Customs Administrations must be able to mobilize necessary resources, perform better collection, storing, processing, exchanging and analyzing the data.

The Automated System for Customs Data (ASYCUDA) is a digital customs management software. It was developed by the United Nations Conference on Trade and Development (UNCTAD) to manage a customs operations of global customs community members. UNCTAD provides technical support to countries and promoted this program internationally in order to prioritize customs clearance processes through the implementing of computerization and simplification of procedures, reducing documentation costs to the economic operators, boosting customs revenue through transparent declaration of goods value, HS tariff code, quantity, country of origin and trade preference regimes. ASYCUDA operates as the united largest technical program in UNCTAD.

This system covers most foreign trade procedures and has implemented by more than nineteen countries worldwide. The system processes cargo manifests and customs declarations, accounting procedures, transit and suspense procedures for imports and exports, warehousing manifest. It has capabilities for originating detailed trade and fiscal data about trade transactions which can be used for reliable statistical economic analysis and planning by Customs and other stakeholders.

ASYCUDA system operates on different types of software in a client IT platform. The data are kept on a relational software package (Data Based Management System – DBMS). It accepts the all codes and standards covering customs operating which have been prepared by International Organization for Standardization (ISO), World Customs Organization (WCO), the United Nations (UN) and adopted globally by Customs administrations. ASYCUDA can be customized to match the national parameters of individual Customs procedures, regulations and legislations, and ensures Electronic Data Interchange (EDI) between economic operators and Customs Administrations using the United Nations rules for Electronic Data Interchange for Administration, Commerce and Transport between independent digitalized information systems (known as UN/EDIFACT). It provides EDI between economic operators and Customs using predominant standards alike Extensible Markup Language (XML). The latest version of the ASYCUDA system called ASYCUDAWorld, it included the latest web-based technology.

## 3.4. ADVANCED INSPECTION AND DETECTION TECHNOLOGIES USED BY CUSTOMS

The legal foundation that determined applying by Customs Administrations on customs control mechanisms are defined in the International Convention on the Simplification and Harmonization of Customs Procedures adopted by Customs Co-operation Council (World Customs Organization). The General Annex of this Convention in Chapter six has stipulated some standard provisions which ensure importance of conducting customs control. Some of the standard provisions are defined below, as:

*"6.1. Standard: All goods, including means of transport, which enter or leave the Customs territory, regardless of whether they are liable to duties and taxes, shall be subject to Customs control.*

*6.2. Standard: Customs control shall be limited to that necessary to ensure compliance with the Customs law.*

*6.3. Standard: In the application of Customs control, the Customs shall use risk management.*

*6.4. Standard: The Customs shall use risk analysis to determine which persons and which goods, including means of transport, should be examined and the extent of the examination.*

*6.9. Transitional Standard: The Customs shall use information technology and electronic commerce to the greatest possible extent to enhance Customs control"*[48].

Customs Administrations are conducting customs control applying on different inspection and detection techniques, and advanced technologies. The latest technique is Non-Intrusive Inspection (NII). *"Non-intrusive inspection technology (NII technology) refers to technical equipment and machines such X-ray or gamma-ray imaging type equipment that allow the inspection of cargo container, means of transport, bag's content without the need to open the means of transport, cargo container, bag's, and unload the cargo"*[49].

Some of large, global manufacture and suppliers of inspection and detection solutions are Smiths Detection (Smith Group), Nuctech, Rapiscan Systems (An OSI Systems Company), AS&E (An OSI Systems Company), S2 Global (An OSI Systems Company).

SMART Customs concept has accepted and designed in many Customs Administrations. As part of SMART Customs architecture, Customs Administrations at border gates (sea, land and air) are used different types of customs control instruments from physical inspection when need it to NII detection and inspection advanced technologies. It can be such technologies as: 1) metal detectors; automated explosives detection screening (EDS) systems for hold baggage; 2) available in different configurations (gantry, mobile, trail, rail) X-ray scanning systems for efficient screening with material discrimination of a bag's content, cargo container and vehicles for threats; 3) handheld inspection devices to detect organic threats and contraband; 4) surveillance systems (CCTV- a video, drones, and such on) to predict suspicious vehicle and cargo on-to-road.

[48] World Customs Organization. International Convention on the Simplification and Harmonization of Customs Procedures (known as the Revised Kyoto Convention). Retrieved http://www.wcoomd.org/Topics/Facilitation/Instrument%20and%20Tools/Conventions/pf_revised_kyoto_conv/Kyoto_New 28 February 2020.
[49] Trade Facilitation Implementation Guide. Retrieved http://tfig.unece.org/contents/NII-technology.htm 28 February 2020.

Picture 13: Always on a service! The Istanbul (Turkey) Customs inspection team go up on a vessel in the Sea of Marmara in search of fuel oil and other smuggled commodities. Source: World Customs Organization, www.wcoomd.org.

The latest technology in X-ray imaging is computed tomography (CT) 3D imaging for greater detection of sophisticated threats. It can be applicable for instance to detect improvised explosive devices (IEDs). It introduces new age of smart solutions to the world of baggage screening, that allows Customs operators to have a layered view and make a more accurate assessment of a bag's contents based on high-resolution 3D images. The features to switching from 2D technology to CT 3D images technology that the last one delivers greater security, efficiency, accuracy, speed, compatibility (based on using Universal Interface), passenger experience streamlining the screening process, eliminates the need to remove electronics, liquids and gels from bags. CT usually used in the medical field, however now area of application of this technology has broaden.

Picture 14: Computed Tomography (CT) Technology with 3D image possibility for more effective detection of threats and contraband. Source Smith Detection, www.smithsdetection.com.



Picture 15: Customs Operator uses CT 3D Image Universal Interface Technology. CT provides higher possibility of automatic threat detection, and low false signal rate. Source Smith Detection, www.smithsdetection.com.

Also, Customs Authorities commonly used various handheld inspection tools for examination of entry/exit travelers a bag's content, means of transport at border check points in order to detect drugs and undeclared currency, or other prohibited items.

*"Z Backscatter imaging system"*[50] that determines organic threats and smuggling helping Customs Inspector to scan in complex reachable places for instance vehicle, plane interiors, and more for drugs, currency, explosives, and other organic threats while on-the-go. It is portable tools based on X-ray technology helps for Customs Officers without unnecessary destruction for instance to vehicle make customs control. The features of this system are capabilities to execute in-depth NII examination of the vehicle on-the-go. It allows easy, fast, and more efficient search inside interior and outside of the vehicle (for example, tires), make informed decisions about availability dangerous and elusive threats and smuggling.



Picture 16: Customs Officer uses handheld device based on Z Backscatter technology (MINI Z) when inspecting vehicle for contraband drugs and currency. Source Rapiscan Systems and AS&E.

The other method of customs control uses reliable surveillance systems. This approach helps to get real-time information to decrease response times, in bad/rain weather or when lightening is difficult to get situational awareness in order to keep response. For instance, Thailand's surveillance systems are connected to SMART Customs concept and Customs Officers can monitor and inform border customs on notice suspicions vehicle and cargo, or travelers. Having video live and data sitting in an operation headquarter, Customs Officer can efficiently coordinate activities, getting a 360° view, ability to zoom in and seizing various data such as vehicle

[50] Rapiscan Systems and AS&E Company website. Products. Handheld Inspection. Retrieved https://www.rapiscan-ase.com/products/handheld-inspection-2/product/MINI-Z on 28 February 2020.

plates or faces. As per AXIS Communications which is the leader in camera industry, the latest new innovative solutions available in surveillance area are: "*1) Lightfinder technology (delivers high resolution); 2) Zipstream technology (preserves all the important forensic detail need); 3) 4K Ultra HD technology (provides up to four times higher resolution than standard HDTV 1080p resolution); 4) Wide Dynamic Range (WDR) technology (revealing details need, maximal forensics usability); 5) OptimizedIR (the advanced way to see in the dark); 6) Sharpdome technologies (sharp images in rainy weather); 7) Radar technology (on target detection); 8) Thermal imaging technology (picturing the invisible); 9) IP technology ( intelligent security and integration into a network system); 10) Electronic Image Stabilization (EIS smooth video, a camera vibration control, clear and precise images)*".[51]



Picture 17: SMART Customs – Three Customs Officers monitor CCTV (Closed-Circuit Television) screens at Operations Center. If they see anything suspicious, they will signal field officers working at the borders. Thailand Customs. Source Photo Competition, 2019. World Customs Organisation, www.wcoomd.org.

The latest trend in Customs Control area as part of SMART Customs concept (Customs 4.0) uses Drones inspectors for surveillance of suspect activity and examination of merchant ships (for instance, Dubai Customs). Merriam-Webster Dictionary has provided definition of drones "*as an unmanned aircraft or ship*

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[51] AXIS Communications Company webpage. Home. Products and Solutions. Technologies. Retrieved https://www.axis.com/products-and-solutions/technologies on 28 February 2020.

*guided by remote control or onboard computers"*[52]. *"Unmanned aerial vehicles (UAVs) are a part of an unmanned aircraft system (UAS) which includes a UAV, a ground-based station, and a system of communications between the two"*[53]. The flight of UAVs may run with different levels of autonomy: either under distant control by an individual operator, or autonomously by onboard computers. Nowadays, drones has wide spectr of application, for agriculture, transport, energy, defense and security industries, and others. The new generation drones has already developed. One of these are known as Scout System and based on ScoutBase station. It is fully autnonomous (from landing to charging to data operating) and powered by Artificial Intelligence (AI). Collecting, processing and analysing data, everything is operated autonomously. Using software and hardware they can to live without the involvement a human pilot. The interaction possible with one or a fleet of Scouts remotely from own facility via ScoutView application installed on mobile device or computer. It possible to build schedule for information collection or initiate missions on demand. The key advantages: pilotless, highest resolution, real-time-data, actionable insights (data can be exctracted)[54].

Today drones are greatly support to law enforcement agencies. As Customs Authorities has law enforcement functions, it would be use drones for visual surveillance not only trade vessels but also transportation process of cargo containers and trucks from entry customs border to destination customs terminal, conduct customs surveillance near, around and from air on Customs Offices at border, provide situational awareness, customs monitoring in open areas (free zone field) as well as in enclosed facilities (customs warehouse, supply chain hubs) and poorly lit or hazardous environments.

For instance, in August 2019 the Customs and Border Protection (CBP) Agency in partnership with Planck Aerosystems Inc., *"began testing its autonomous small Unmanned Aircraft System (sUAS) in operational settings"*[55]. Plank used its technologies in order to provide CBP a sUAS capably to launch from and land on the bed of a moving vehicle, complementary providing fully autonomous navigation linked with a securing mechanism cutting edge computer vision, customized communication interfaces. Through a combination of integrated technologies, including full-motion video, automatic target detection and geolocation, Planck seeks to provide CBP officers with a portable, ruggedized detection system that provides real-time situational awareness in the field. At present in U.S. Customs and Border Protection's (CBP) Air and Marine Operations

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[52] Merriam-Webster Dictionary. Definition of Drones. Retrieved https://www.merriam-webster.com/dictionary/drone on 29 February 2020.
[53] World Customs Organization (WCO): Study report on Disruptive Technologies, June 2019. Publisher World Customs Organization, Belgium.
[54] American Robotics, Inc. webpage. Retrieved https://www.american-robotics.com/ on 29 February 2020.
[55] Planck Aerosystems Inc. DHS S&T awards $200K to San Diego's Planck Aerosystems Inc. for final testing of small Unmanned Aircraft System. NEWS (September 2019). Retrieved https://www.planckaero.com/news/2019/9/4/dhs-sampt-awards-200k-to-san-diegos-planck-aerosystems-inc-for-final-testing-of-small-unmanned-aircraft-system on 29 February 2020.

(AMO) in arsenal available *"the highly capable and proven Predator B unmanned aircraft system (UAS) to further enhance operational capabilities and increase domain awareness. AMO selected the Predator B, manufactured by General Atomics Aeronautical Systems, for its unique combination of operational capabilities, payload capacity, mission flexibility, potential to accommodate new sensor packages, and its safety and performance record with other federal agencies. The UAS program focuses operations on the CBP priority mission of anti-terrorism by helping to identify and intercept potential terrorists and illegal cross - border activity. The remotely - piloted Predator B allows AMO personnel to safely conduct missions in areas that are difficult to access or otherwise too high -risk for manned aircraft or CBP ground personnel"*[56].

Drones application area by law enforcement agencies will increase in future rapidly, due they are multipurpose, difficult detectable, and relatively inexpensive. They can link together information from various sources.



Picture 18: Small Unmanned Autonomous System (sUAS) in action. Source Eval Miko/Shutterstock via Defense One. www.defenseone.com.

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[56] U.S Customs and Border Protection. Unmanned Aircraft System MQ-9 Predator B. Retrieved https://www.cbp.gov/sites/default/files/assets/documents/2019-Feb/air-marine-fact-sheet-uas-predator-b-2015.pdf on 29 February 2020.

Picture 19: A Predator B unmanned aircraft at an event hall. Visitors to celebrate the FAA's permission of the UAV's use along the Texas-Mexico land border. Source Eric Gay/AP via The Atlantic, www.theatlantic.com.

# 4. CONCLUSION

The importance of Customs on local and global level are strong. They work in different terms and security environments due some countries have much more resources (financial, technological, human) to secure their bodies, the others still exist in (post-) conflict areas (such as Chad, Mali, Sudan, Tunisia, Libya and the Central African Republic), with undeveloped or developing economy with lack of border customs infrastructure. Customs administration's role in trade regulation and trade balance, and its priority place in delivering cash through collecting duties and taxes to state budget is crucial. After State Tax Administrations, Customs is the second by size bringing big portion of revenue to government treasury. It also means that other state entities which are not revenue collectors are greatly benefited from this cash flow to state account. Customs is usually the most important state organization dealing with businesses and middlemen, such as customs brokers, port agents and logistics/carriages companies. Middlemen building a relationship with and negotiate with Customs Authorities. This is significant in post conflict or new created jurisdictions where the official state's position is new presented or restored at unstable borders. In developed countries vice versa tries avoids Customs and Business or Middlemen direct relations and negotiations, building digital customs allowing communicate using all capabilities of advanced information communication technologies. The good example is Electronic Data Interchange concept or various blockchain platforms developed for needs of trade and supply chain. They are aimed on paperless, fast customs clearance operations, easy revenue collection and low risks of trade fraud (for example over-invoiced/under-invoiced) or documentation forgery, transparency and visibility. However, certain line of cooperation between Customs and Private Sector exists in order to share expertise, latest industrial trend and help Customs to provide better solutions for trade facilitation and businesses requirements.

The World Customs Organization has pragmatic approaches which plays a major role in the development of trade flows and strengthen compliance regulation, law enforcement activities through building global harmonized and optimized standards, policies and developing SMART Border Customs (Customs 4.0) concept which drives for great changes in Customs organisations.

The technological drive in Customs organisations covers five main areas: Global environment; Accountability; Efficiency and Service delivery; Business Simplification and Technology.

Technology helps grow productivity and make better decisions while preventing trade fraud and identify deviation.

Customs uses external and internal audit mechanism. External audit covers pre customs clearance and post customs clearance stages, internal focused to identification of any erosions inside Customs Administrations, such as preventing corruptions or irregularities, and make management changes.

Customs Authorities becomes service-oriented organisations. They acknowledge importance reducing barriers to trade. Customs is connecting to businesses through integrated digital platforms, supporting E-Commerce, speeding trade facilitation and customs clearance processes, reducing logistics-supply chain cost and thus helping industry and market needs in more efficient way.

Impact of disruptive technologies has changed the way of conducting Customs activities, especially in law enforcement and security applications. These technologies are being used by criminal groups to avoid customs laws and regulations and violate borders. Smugglers may have means of delivery (cars, drones) that allow them certain level of flexibility to cross national borders and bypass the control of customs. As already discussed in previous chapters drones are being used for illegally movement of goods or drugs trafficking through national borders of countries.

We are leaving in age where many of processes have switched from traditional on digital using power of automation and robotics. Below are listed some recommendations which author believes important in the future of Customs Administrations working in 21$^{st}$ digital and automated era. They are next:

1. Customs Administrations in depend of organisational needs and service requirements, resource availability must look at options for cutting edge technologies and evaluate it for further areas of application and implementation. The best option for Customs Administrations to build SMART Customs are using as much as possible technologies of Industrial Internet of Things (IIoT), Biometrics-Facial recognition, Robots, Drones and Video surveillance in integrated way.

2. Customs data analytics as part of risk management system should be deployed stronger across National Customs Administrations, due it is great opportunity for Customs to keep streamline decisions for customs control in respect of inbound/outbound travellers, borders, cargo containers, means of transport in more right and efficient way, reducing threats.

3. Effective exchange of data between National Customs Administrations should be developed in order to predict illegal trade and dangerous contraband activities in advance, and rapidly prosecute. It possible through connection of customs networks for electronic data interchange or building single global network for Customs operated by World Customs Organisation.

4. Customs Administrations need to actively develop dialogue and partnerships with business community, research and development institutions on local and international level through establishing effective and live cooperation, developing joint programs. It should be done for building customs capacity, share knowledge purposes and situational awareness about trade trends and industry requirements. Such collaboration format will be benefited in each country for dialogue between State Customs and Business community.

5. Customs Administrations also participates in delivery of sustainable development goals promoted by United Nations. Thus, they need to consider Global ecosystem (for instance industrial, environmental) and focus on Green Customs initiatives. It will add value for prevention of Climate change and Saving the Ozone layer through efforts of reducing emissions in atmosphere, minimizing generation of waste, and foster safe and responsible energy usage.

6. Knowledge Academy is crucial for Customs Administrations. They need to train Customs Officers more actively in order to prepare for quality performance of tasks in digital age. Customs Officers must understand capabilities and properly deal with latest emerging technologies. Skilled Customs Operators are future of Customs success.

7. Institute of Leadership must be also developed in Customs Organisations. It is important to acquire talents internally organisation as well as externally, building strong capacity for achievement of mission, strategic goals and organisational objectives, promoting Customs values.

A strong expectation of States from Customs Administration on the requirements to levy more cash to invest in new social or infrastructure projects, for sustainably operations of States institutions and further increasing of Economy, in some Africa countries even for poverty decrease, still too high. Undoubtedly, that the digitalisation and automation of processes is the right way for boosting trade facilitation and collecting tax and duties in more efficient and fast way, keeping secure health and safety of community, identifying and preventing of illegal activities.

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# 6. LIST OF PICTURES, FIGURES, MAPS, CHARTS, DIAGRAMS

Picture 1: The photo shows drones and wires captured by the Shenzhen Customs for above case. Source www.chinadailyhk.com.

Picture 2: On photo Cargo and Vehicle Inspection System (Non-intrusive inspection technology (NII)), Belgium Customs. Source World Customs Organization.

Picture 3: Baku, Azerbaijan. Source www.tradelens.com.

Picture 4: The Regional Office for Capacity Building (ROCB) for the World Customs Organization (WCO) Europe Region in Baku, Azerbaijan. Source https://rocb-europe.org.

Picture 5: In polyethylene bags contains home-made drugs (heroin), seized by Azerbaijan's Customs (2018). Source State Customs Committee of Azerbaijan.

Picture 6: Customs officer uses a mobile device to track and trace stamped alcohol, Guyana Customs. Source Photo competition, 2019. World Customs Organization.

Picture 7: RFID Handheld Reader to read RFID E-Seal at Customs Station. Source www.harcor.com.

Picture 8: Targeted checks, Customs Inspector from the Image Analysis Station look at a scanned image while their colleagues conduct a physical inspection of the same suspicious cargo. Singapore Customs. Source Photo competition, 2019. World Customs Organization.

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Picture 10: Screen captures from DaiSy, an analysis software tool from Smiths Detection. Next Generation Cargo X-ray. Source Smiths Detection via CEA.

Picture 11: Evaporation based detector, as complimentary to X-ray imaging. Source C-BORD project webpage.

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Picture 17: SMART Customs – Three Customs Officers monitor CCTV (Closed-Circuit Television) screens at Operations Center. If they see anything suspicious, they will signal field officers working at the borders. Thailand Customs. Source World Customs Organisation.

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Picture 19: A Predator B drone at a ceremony to celebrate the FAA's authorization of the aircraft's use along the Texas-Mexico land border. Source Eric Gay/AP via The Atlantic.

Figure 1: Belgium launched digital customs platform – BE-GATE simplifies e-commerce (Port of Antwerp). www.freightcomms.com.

Figure 2: It shows how the Sanbot Max QIHAN humanoid robot looks and their functions. It is being used as a customs inspector in some seaports in China. Source Electronic Specifier, robotics.

Figure 3: Blockchain (blocks that are linked using cryptography). Source World Economic Forum.

Figure 4: Blockchain. Share and Track Logistics Info. Source Samsung SDS Co.

Figure 5: Blockchain. Digital Identity process. Source Samsung SDS Co.

Figure 6: Blockchain. Digital Payment process. Source Samsung SDS Co.

Figure 7: It shows the GTAS Integrated Workflow system. Source World Customs Organisation-GTAS.

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Map 2: The eTIR pilot project between the Iranian and Turkish Customs authorities, two transport operators, and the two countries' respective TIR Guaranteeing Associations. Source World Customs Organization (2016).

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Chart 2: Chart shows World merchandise exports and imports by level of development, 2012Q1-2019Q2. Volume index, 2012Q1=100. Source WTO and UNCTAD.

Diagram 1: Diagram of Industry 4.0, Deloitte The Netherlands. Source https://documents.deloitte.com/insights/DeloitteReview26.

Diagram 2: A diagram shows general project overview. Source C-BORD project website.