Managing Risk for Safe, Efficient Trade

GUIDE FOR BORDER REGULATORS

International Trade Centre

In collaboration with

UNECE

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About the paper

A comprehensive risk management strategy is vital to improve the efficiency of border control and import compliance to facilitate international trade. This publication offers a roadmap that shows regulatory agencies in developing countries in particular how to build modern, integrated risk management and compliance systems at the border.

The guide aims to help these agencies expedite trade flows in the post-pandemic world, while ensuring compliance with and the safety of cross-border trade procedures. It offers policy recommendations to create a national strategy based on five principles, such as removing redundant controls and integrating risk management processes.

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Foreword

The COVID-19 pandemic has affected our lives beyond imagination, disrupting supply chains and societal habits worldwide. This unprecedented situation has reminded us – more than ever – of the importance of ensuring fast and efficient trade flows across borders.

Customs administrations and border regulatory agencies have coped with exceptional circumstances to expedite the supply of goods while ensuring compliance and safety, particularly in economies in transition. The pandemic showed the structural challenges that many border regulatory agencies face in striking a balance between border compliance and trade facilitation. This makes an even stronger case for risk management.

Robust risk management must be in place to speed up low-risk trade while managing risks at the border. Limited resources, coupled with poor or outdated risk management techniques, often create avoidable inefficiencies. This can be seen in an ineffective allocation of human and technical resources, as well risk analysis and inspection processes that too often lead to high inspection rates and low levels of accuracy.

A risk management system also must be integrated and holistic. Managing risks in line with trade facilitation principles is a duty of customs authorities, and the common endeavour of all regulatory agencies involved in cross-border trade transactions. A multi-agency, coordinated approach to risk management is the real success factor behind international trade operations that are efficient and safe.

New technologies contribute to better data-driven risk management systems. Artificial intelligence, for example, can facilitate the accurate collection, assessment and use of data for risk-based decision-making. While a common-sense approach based on knowledge of the business environment and expert judgement is important, adopting a scientific-based approach will result in accurate analysis and management of country risks.

We are pleased to present this joint work, developed in partnership between the International Trade Centre and the United Nations Economic Commission for Europe. It provides a unique roadmap to implement a modern risk management system that is integrated and interconnected, where all border agencies carry out their mandate in a synchronized manner with a view to reduce the time and cost of doing business.

This guide is the first publication dedicated to coherent, integrated risk management by border regulatory agencies in developing countries. It supports trade development that depends on safe, efficient trade procedures. We hope border regulatory authorities, policymakers and economic operators will use this guide to work together to enhance their national risk management systems and help build the supply chain resilience beyond the COVID-19 pandemic and future crises.

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Contents

Boxes

Tables

Figures

Acronyms

Unless otherwise specified, all references to dollars ($) are to United States dollars, and all references to tons are to metric tons.

AEO	authorized economic operator
ASYCUDA	Automated System for Customs Data
BACUDA	Band of Customs Data Analysts
CRM	customs risk management
EU	European Union
FDA	United States Food and Drug Administration
GDP	gross domestic product
HS	Harmonized System
ICT	information and communication technology
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
IT	information technology
ITC	International Trade Centre
OECD	Organisation for Economic Co-operation and Development
OSCE	Organization for Security and Co-operation in Europe
PREDICT	Predictive Risk-based Evaluation for Dynamic Import Compliance Targeting
SDGs	Sustainable Development Goals
SPS	sanitary and phytosanitary measures
TBT	technical barriers to trade
TFA	Trade Facilitation Agreement
UN/CEFACT	United Nations Centre for Trade Facilitation and Electronic Business
UNECE	United Nations Economic Commission for Europe
WCO	World Customs Organization
WTO	World Trade Organization
WCO	World Customs Organization
WTO	World Trade Organization

Executive summary

Risk management in service of safe and efficient trade

The safety of international trade is as important as its efficiency. While trade represents an opportunity, it has also always been a source of risk. Regulatory authorities deal with a diverse group of risks that are associated with traded goods and can have undesirable impacts on consumers, society and the environment. These risks require regulatory intervention and management of non-compliance risk at the border.

Risk management is a key trade facilitation measure and its efficient application is a prerequisite to reduce non-tariff trade costs. As a tool that allows regulatory authorities concentrating on high-risk shipments, risk management helps reduce redundant or sequential border controls that cause delays and impose unnecessary costs on traders.

Good risk management leads to more efficient use of the limited resources of regulatory agencies involved in border control. It also helps improve cooperation among regulators by ensuring compliance with export, transit and import procedures.[1]

The COVID-19 pandemic highlighted the crucial role of risk management in border control. Managing risk to allow low-risk critical supplies to pass clearance controls quickly is one of the most important trade policy responses to the crisis.[2]

Countries must streamline regulatory and border procedures to improve access to pandemic-related medical goods and essential foods. Regulatory authorities need to evaluate the non-compliance risk of products correctly, so they can remove the need for applications, permits and licences for goods that pose minimal risk to human health and environmental safety and streamline the procedures for other products, taking into the account their levels of non-compliance risk.

Border control procedures also must be proportionate to the level of non-compliance risk of each incoming shipment. This is to ensure that shipments can be released quickly if the probability that they contain a non-compliant product is low or if the consequences of having this product on the market – even if it is non-compliant – can be tolerated.

The challenge of implementing effective risk management systems

The World Trade Organization (WTO) Trade Facilitation Database showed in 2022 that risk management was one of the five measures with the lowest implementation rate (with 65.5% of implementation commitments).[3] Implementing risk management within trade procedures remains a challenge for many countries. Most countries that had fully implemented risk management systems hadn't shown any reduction in time and costs of border compliance procedures years after the system started functioning.[4]

Two broad challenges explain why risk management has failed to improve border compliance procedures significantly. The first involves building the risk management capacity of regulatory agencies involved in border control, for example, processes, methodologies, information technology (IT) systems and competences designed to ensure that risk is managed efficiently and effectively.

If evaluations of incoming shipments are biased or incomplete or if no risk criteria based on regulatory objectives are established, risk management will result in mitigation measures that are not proportionate to the risks they were set out to address.

The second set of challenges is related to integrating the risk management procedures of all regulatory agencies involved in border control and to the functioning of an import compliance framework as a whole. In practice, borders are very busy areas: in some countries, as many as 25 regulatory agencies can be involved in border control – sometimes inspecting one shipment.[5] Each agency is responsible for its own set of non-compliance risks associated with every incoming shipment.

The case for implementing integrated risk management systems

As a chain is as strong as its weakest link, risk management at the border is as good as it is applied by the least efficient regulatory agency. If just one regulatory agency lacks the IT or human resources to evaluate risks and act accordingly, the entire system will be inefficient.

Differences in approaches to risk evaluation are also important. If the criteria that regulatory agencies use to evaluate the level of non-compliance risks of incoming shipments under their responsibility are not harmonized, implementation of risk management, even if applied by all agencies involved, will not reduce border compliance time and costs.

Indeed, risk management efforts in many countries seem to have stalled at the single agency (customs) stage and have yet to achieve their full potential. Customs, though playing a key role in border control, is only one of the agencies involved in border processing. According to the World Bank, evidence suggests that customs is often responsible for no more than a third of regulatory delays and that traders are far more satisfied with the performance of customs than with that of other border management agencies.[6]

Building a national strategy

Improving the efficiency of border controls and import compliance to facilitate international trade means developing and adopting a comprehensive risk management strategy, which includes building integrated risk-based import compliance frameworks.

This strategy, which aims to facilitate trade while protecting the health and safety of consumers, society and the environment by removing redundant and sequential controls, has the following benefits:

- From the international trade perspective, it supports and leads to more efficient implementation of the risk management principles of the WTO Agreements, in particular the Trade Facilitation Agreement, the Technical Barriers to Trade Agreement and the Agreement on Sanitary and Phytosanitary Measures. It introduces and highlights the concept of a non-compliance risk, which is essential to ensure that controls of every agency involved in import compliance support regulatory objectives.

- Non-compliance risks are prioritized according to both severity of the consequences of a product's non-compliance with relevant regulations, (that is, according to their impact on regulatory objectives), and on the probability that an incoming shipment contains a non-compliant product.

- From the market surveillance perspective, strengthening the role of import compliance would increase the efficiency of enforcement activities of product regulators.

- Integration directions of the strategy provide for the most efficient application of risk management in border control and ensure a holistic approach in designing an import compliance framework. This is vital for collaborative border management.[7] An integrated approach, which usually implies integrating the risk management processes of regulatory agencies in the risk management system of customs, results in a comprehensive overview of risks. It also allows for the functioning of an import compliance framework to be analysed as a whole, using border compliance times as main evaluation metrics.

Finally, an integrated approach helps ensure the efficiency of risk management at the border, as it:

- Creates a common risk management language and processes at the border, including for defining risk tolerance and managing non-compliance risks;

- Leads to more efficient cooperation among regulatory authorities by allowing for consideration of correlations among risks and findings of agencies involved in border control, using common data models and cooperating to develop risk profiles and compliance rules;

- Saves resources of regulatory agencies by enabling regulators to share of risk management expertise, IT infrastructure and software tools and processes when they develop and apply risk profiles and target non-compliant shipments. An integrated framework means all types of non-compliance risks of incoming shipments can be evaluated within one IT system based on an integrated data source.

The top challenge of this strategy is linked to the complexity of projects needed to implement it. The strategy covers different aspects of border control and brings together several standalone areas. Its implementation requires running a portfolio of projects whose structure would depend on the risk management maturity of the existing framework, both in terms of the individual capacity of participating agencies and of the level of integration processes.

Implementation roadmap and structure of the guide

The roadmap to build integrated import compliance systems at the border follows the strategy described above and contains the following layers:

1. Organizational level: implementation of formal risk management within regulatory agencies.

2. Regulatory system level: ensuring that relevant regulatory systems – those containing border control as a building block – support the Sustainable Development Goals (SDGs) and are risk-based.

3. Import compliance level of a regulatory agency: applying profiling and targeting techniques in regulatory agencies responsible for border control to evaluate the non-compliance risk of incoming shipments.

4. Integration level: integrating the import compliance systems of regulatory agencies involved in border control.

Implementing formal risk management at the organizational level forms the basis of the roadmap to build an integrated system. It aims to ensure common understanding of the risk management methodology and its application by all regulatory stakeholders involved in international trade and in border control, including businesses. Chapters 1 and 2 support this phase of the roadmap.

Chapter 1 presents trade as both a risk mitigation policy tool and a source of different and severe risks. It provides a classification of cross-border trade risks and explains the increasing importance of managing non-compliance risk in trade transactions. It describes the role of international trade in the 2030 Agenda, analyses the WTO Agreements from the risk management perspective and develops a list of risk management principles of international trade.

The first chapter further highlights the importance of non-compliance risks in international trade and presents risk management in the context of other trade facilitation measures. It examines the current level of risk management implementation in border control, its impact on compliance procedures and how the efficiency of risk management as a trade facilitation tool can be improved. The chapter concludes with a detailed description of the main elements of the national risk management strategy presented above.

Chapter 2 presents an overview of the risk management concepts and tools that are especially relevant in the context of international trade and on which import compliance processes applied by regulatory agencies are based. It highlights the difference between formal and intuitive risk management, describes the objectives of risk management (emphasizing that zero risk cannot be a valid regulatory objective), shows how to identify a risk and provides tools for choosing the best response to risks.

Applying formal risk management in regulatory authorities constitutes the necessary basis to build risk-based regulatory frameworks that support relevant SDGs, which constitutes the second phase of the implementation roadmap. Non-compliance risk cannot be managed without considering all other elements of regulatory systems. Import compliance procedures that regulatory authorities apply at the border are an indispensable part of market surveillance systems.

These systems, as a form of post-market control, are a part of bigger regulatory frameworks that contain two other main elements: regulatory requirements for products and services, and conformity assessment procedures, as a form of pre-market control. For import compliance to be efficient, all elements of regulatory systems should be proportionate to the risks they were set out to address and balanced.

Chapter 3 explains how to build risk-based regulatory systems that support the SDGs. It describes import compliance procedures – presented as key risk mitigation measures to ensure safety of international trade in Chapter 2 – from a slightly different, but equally important, perspective as one of the building blocks of regulatory frameworks.

The chapter describes the concept of the non-compliance risk and shows how managing non-compliance risk at the border supports the SDGs. It shows that in many cases, import compliance procedures that are properly integrated with other elements of the framework are the most efficient form of market surveillance and enforcement.

After proportionality of regulatory requirements, conformity assessment and market surveillance procedures (within each regulatory framework represented at the border) to risks to regulatory objectives is established, individual capacity of border control agencies in applying risk management tools can be enhanced based on international best practice. It includes applying profiling and targeting techniques for prioritizing border inspections on the basis

of non-compliance risk. This phase of the implementation roadmap is more technical and is supported by three chapters that provide technical guidance on building targeting systems.

Chapter 4 presents a holistic reference model for a targeting system that any border control agency can use. It discusses the main parameters of a risk-based compliance system and describes tools to design the main inputs into the system: risk tolerance of a regulatory agency and a model of a non-compliance risk. Using an imaginary case study as an example, it offers practical guidelines on building such systems.

This chapter describes tools that regulatory authorities could use to develop compliance rules and build risk profiles to assess every incoming shipment, as well as to evaluate them based on risk tolerance. It underlines the steps that a regulatory authority must take to apply these compliance rules and to choose a sampling plan that is proportionate to the level of the non-compliance risk of a shipment.

Customs authorities operate in competitive surroundings and try to address challenges and requirements to deliver their services through electronic and digital means. Having an appropriate internal regulatory framework on risk management and adapting the existing organizational structure and administrative procedures provide a proper basis for a more effective risk management system.

Chapter 5 describes how the customs authorities can apply the targeting techniques described in Chapter 4. It demonstrates that using targeting techniques based on different information sources and advanced data analytics helps identify risk and reconciles two seemingly mutually exclusive goals: revenue maximization and trade facilitation. It also addresses the need to adjust dedicated control strategies for each mode of transport, taking into account the specificities of each mode.

This chapter proposes measures to minimize the impact of the COVID-19 crisis on economies and societies.

Chapter 6 describes a general methodology that regulators can apply to manage the risk of product non-compliance. Import compliance procedures are key tools to manage non-compliance risks of traded goods.[8] Non-compliance risk of a product comprises two main parameters: the consequences of non-compliance, associated with a product (how dangerous a product can be when non-compliant), and probability of non-compliance (how likely it is to find a non-compliant product in a shipment or on the market). It offers examples of several frameworks used by regulators responsible for food, agricultural and animal products, as well as electrical appliances.

Risk-based import compliance systems developed according to reference model described in Chapter 4 and international best practice presented in Chapters 5 and 6 can be integrated into a single framework, which is the final phase of the roadmap. **Chapter 7** presents the technical guidance on integrating import compliance systems, focusing on the procedures of customs and product regulators involved in border control. It describes approaches to integrate the main elements of targeting systems of regulatory authorities and emphasizes the benefits of integration.

The chapter connects integrated risk management with other trade facilitation tools, such as the single window, and introduces the concept of an integrated risk management framework. It describes functions of targeting centres that customs authorities can operate to run an integrated system. Recognizing the leading role of customs authorities in managing borders, this chapter develops a model of an integrated assessment of shipments and contains practical guidance on running projects to build integrated import compliance frameworks.

Businesses are clients of integrated systems and should partner with regulators to optimize the effectiveness of risk management. **Chapter 8** advises economic operators how to cooperate and engage with border regulatory agencies and to promote compliance by investing in internal reforms and applying best practices.

Who should read the guide?

This publication addresses many issues, including risk management, regulatory systems, machine learning and targeting, and market surveillance. The relevance of each chapter depends on the maturity of the risk management application in the import compliance system of regulatory authorities and the border control framework.

Regulatory authorities involved in border control are the key target audience of this publication. Product regulators and import sections of ministries can get comprehensive guidance to improve their risk management capacity and more efficiently manage non-compliance risks. Chapters 1-4 and 6 are the most relevant chapters for regulatory authorities.

High-level government representatives. Integrating the risk management systems of regulatory agencies at the border requires a high-level governmental perspective. This guide should help governments arrange efficient cooperation among regulatory agencies involved in border control in terms of common risk management methodologies, sharing IT infrastructure and risk management expertise. The most relevant chapters are 1-3 and 7.

Trade facilitation bodies. The guide can help public and private trade facilitation bodies get a full picture of their role in integration projects and running an integrated risk management system.

Policymakers. The publication shows how to strengthen risk-based regulatory systems to support the SDGs. It can help shape projects for implementing national risk management strategies aimed at ensuring efficient border compliance and trade facilitation, which is crucial for many of the SDGs. The summary of the guide offers a high-level overview of the approaches required to implement the strategy, while Chapter 3 contains a detailed description of regulatory systems for the SDGs.

Customs authorities. Customs authorities are the leading agencies in integration projects and in most cases, the risk management system of these authorities is used as a basis for integration. Customs would benefit from a holistic model of a targeting system and a description of the risk management best practice in customs procedures. The most relevant chapters are 4, 5 and 7.

Economic operators/traders. Business can play a central role in this process by engaging, where possible, in an ongoing dialogue and advocacy with the border regulatory agencies and trying to improve their own compliance. This is addressed in a dedicated chapter that suggests practical and operational steps to strengthen the risk management and trade facilitation process as partners and collaborators, and how this can encourage a conducive trading environment.

International organizations and donors. International organizations and donors can use this guide as a basis for running capacity building and technical cooperation projects that help countries implement national risk management strategies.


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Chapter 1

Managing risks at the border

Managing risks at the border

International trade and trade facilitation play a major role in achieving the Sustainable Development Goals (SDGs). As international trade can be both a risk mitigation tool and a source of risks, risk management is presented in this chapter in the context of trade procedures and trade facilitation.[9]

Mitigating risks to sustainable development

International trade is a major driver of economic growth, poverty reduction and sustainable development. It plays a crucial role in the implementation of the 2030 Agenda, which calls for a 'universal, rules-based, open, transparent, predictable, inclusive, non-discriminatory and equitable multilateral trading system'.[10]

Some strategies to achieve certain SDGs and targets mention the international trade system and present trade development as a risk mitigation tool:

- Achieving the 'zero hunger' goal requires correcting and preventing trade restrictions and distortions in world agricultural markets;
- Trade-related aspects of intellectual property rights are mentioned in the 2020 Agenda the context of supporting the research and the development of vaccines and medicines, essential to ensure public health (3b). This is especially important in light of the COVID-19 crisis, which highlighted the need to guarantee access to affordable medicines, especially for developing countries;
- Increasing exports of developing countries is presented as a strategy to promote sustained and inclusive economic growth (8a), and to reduce inequality in and among countries (10a);
- International trade and World Trade Organization (WTO) agreements are mentioned in the context of protecting the oceans, seas and marine resources, as one means to mitigate the risk of overfishing and overconsumption.

Well-planned and strategically executed trade policy initiatives support sustainable poverty reduction; trade creates opportunities for women's employment and economic development, because export sectors are an important source of jobs for women in developing countries. In general, trade and open markets increase competition and the transfer of technology, knowledge and innovation.[11]

Achieving most of the SDGs requires efficient international trade simply because these goals rely on products that are traded on the international markets. Similar to how efficient trade in agricultural and food products is crucial for achieving the SDG 2 'zero hunger', and trade in vaccines and medical equipment is a prerequisite for SDG 3 'good health and well-being', progress in reaching most of the SDGs depends on the quality, availability and safety of a wide variety of products, and thus on the efficiency of the international trade system.

The safety of international trade is just as important as its efficiency. To ensure that international trade doesn't compromise the achievement of some of the goals and targets of Agenda 2030, these risks should be systematically addressed at all levels: from high trade policy level to deciding how a shipment with imported goods should be inspected.

Trade as a source of risks

Historic overview

As trade has always been associated with risks, international trade and risk management have a long and shared history. It was in the context of trade, specifically to mitigate the risks facing exporters and importers, that many risk management strategies and tools – from insurance to hedging instruments – were first introduced.

The need to mitigate risks of traders led to the invention of the insurance industry. The Emperor Claudius (10 BC-AD 54), eager to boost the corn trade, made himself a one-man, premium-free insurance company by taking personal responsibility for storm losses incurred by Roman merchants. Occupational guilds in both Greece and Rome maintained cooperatives whose members paid money into a pool that would take care of a family if the household head died prematurely.

The famous Lloyd's List, filled with information on the arrivals and departures of trade ships to London and intelligence on conditions abroad and at sea, marked the beginning of one of the biggest insurance companies.

The need to minimize the impact of price volatility and exchange rates on traders led to the development of complex financial instruments, such as futures and options that are widely used today in hedging strategies. Already in the twelfth century, sellers at medieval trade fairs signed contracts, called lettres de faire, promising future delivery of the items they sold.

In the 1600s, Japanese feudal lords sold their rice for future delivery in a market called cho-ai-mai under contracts that protected them from bad weather or warfare. For many years, in markets such as metals, foreign exchange and agricultural products, contracts for future delivery have been used to protect against the risk of volatile prices.[12]

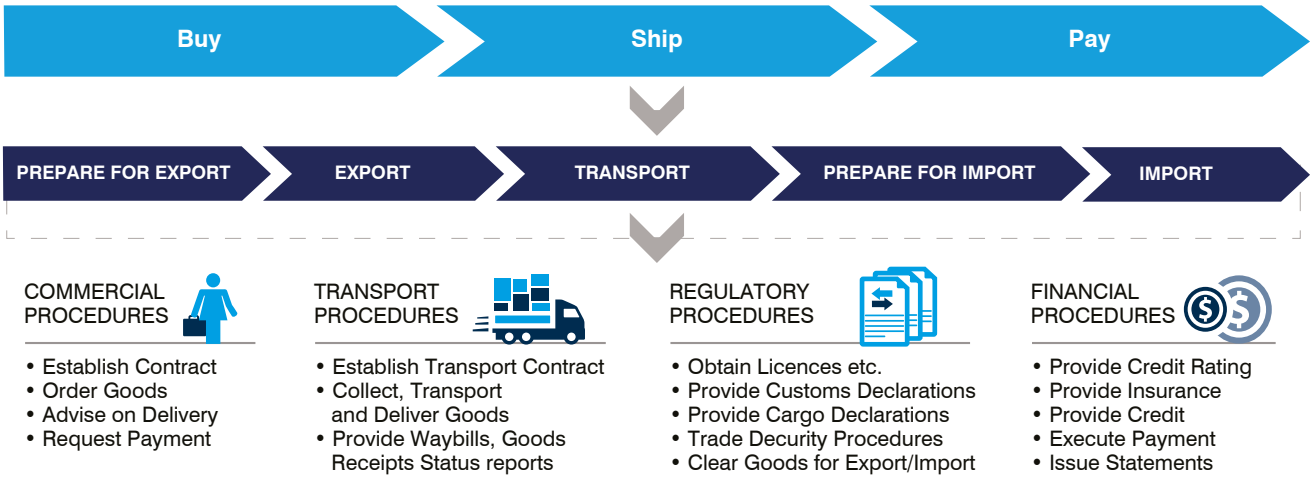
Chinese traders applied diversification strategies as early as 3,000 years ago: traded goods were redistributed across vessels to limit losses.[13]

Risks for importers and exporters

Understanding the risks of international trade requires a comprehensive view of the international supply chain and trade procedures. The United Nations Economic Commission for Europe's (UNECE) International Supply Chain Reference Model,[14] also known as buy-ship-pay model, illustrates the steps in the supply chain and models commodity trade across national borders.

The model groups the main procedures that support international trade transactions into four categories: commercial, transport, regulatory and financial. It also provides a basis to identify the main stakeholders involved in each procedure.

Figure 1 International supply chain reference model



Source: UNECE (2012). Trade Facilitation Implementation Guide. Available at https://tfig.unece.org/contents/buy-ship-pay-model.htm.

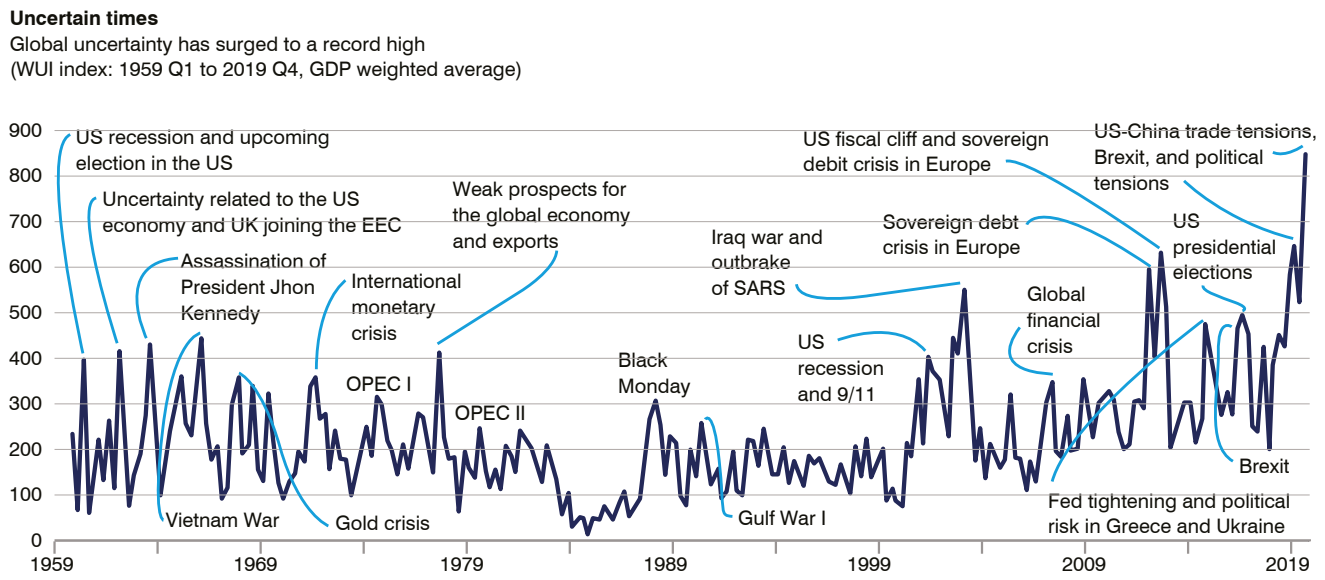
The United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT)[15] model can be used to develop a taxonomy of risks to which importers and exporters are typically exposed. These risks are an important part of international trade that must be understood by regulatory authorities to facilitate trade. Traders face the procedures described in the UN/CEFACT model as main business processes.

Table 1 UN/CEFACT model identifies key risks for traders[16]

Procedure	Risk category	Examples of importer/exporter risks
Commercial procedures	Business risk	Demand for the imported product changes
	Supplier risk	Exporter fails to supply the product
	Quality risks	Poor quality of imported products
		Product liability risks: product causes injury or damage to a person or a person's property
Financial procedures	Credit risk	Exporter fails to supply the product Foreign buyer fails to pay for the exported product Insolvency of the buyer, bankruptcy or protracted defaults/slow payment
	Currency risk	Devaluation of the local/foreign currency
Transport procedures	Transportation risk	Physical loss or damage to the goods during transport
	Logistics risk	Transport delays
Regulatory procedures	Legal risk	Introduction of new requirements on imported products Changes in import or export regulations Imported products do not comply with regulations
	Regulatory risk	Delays caused by import inspections and border compliance

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Figure 2 Global uncertainty hit a high point in 2019



Note: The WUI is computed by counting the frequency of the word «uncertain» (or the variant) in Economist Intelligence Unit country reports. The WUI is then normalized by total number of words and rescaled by multiplying by 1,000. A higher number means higher uncertainty and vice versa. The aggregate and disaggregate data by country and regions are available at www.worlduncertaintyindex.com.

Source: Ahir, H., Bloom, N., and Furceri D. (2020). 60 years of uncertainty. Finance & Development.

Credit risk – buyer insolvency or other factors leading to non-payment for the exported product – is the biggest exporter risk. Importers face a wider variety of risks. Some of these, such as legal and regulatory risks (delays caused by import inspections and border compliance, introduction of new requirements on imports, non-compliance of imports with regulations), are related to risk mitigation measures that regulatory authorities impose for safety and other policy objectives.

Uncertainty in supply chains

On the policy level, uncertainty associated with demand and supply of traded products is a source of major trade risk. The gravity equation[17] can be used to demonstrate this type of uncertainty. According to the equation, 'normal' values of exports from one nation (the origin nation) to another (the destination nation), depend on two factors:

- the destination's aggregate demand (as measured by its gross domestic product)
- the origin's aggregate supply (as measured by its gross domestic product)

In the model, the product of gross domestic products (GDP) is divided by the bilateral distance, reflecting that bilateral exports are proportional to economic size and inversely proportional to geographic distance. As distances don't change, uncertainty associated with exports can be modelled by a parameter dependent on changes in the GDP of the origin nation, and changes in demand by modelling the uncertainty in the GDP of the destination nation.

Predictions made at the beginning of the COVID-19 crisis,[18] which were based on this model, included:

1. Direct supply disruptions hindering production, as the virus is focused on the world's manufacturing heartland (East Asia) and spreads quickly in the other industrial giants – the United States and Germany.

2. Supply-chain contagion will amplify the direct supply shocks as manufacturing sectors in less affected nations find it harder and/or more expensive to acquire the industrial inputs they need from hard-hit nations, and subsequently from each other.

3. Demand disruptions due to macroeconomic drops in aggregate demand, i.e. recessions, and precautionary or wait-and-see purchase delays by consumers, and investment delays by firms.

Though the crisis was far from over at the time this guide was written, it appeared that trade had dropped far less than expected.[19]

The World Uncertainty Index[20] shows that international trade can cause spikes in global uncertainty.

At the same time, international trade is also highly volatile due to global uncertainty and economic crises. During the 2008 economic crisis, for example, globally, industrial production fell 13% and trade volumes dropped 20% in the 12 months from April 2008.[21]

Risks for consumers, society and environment

From a slightly different perspective, growth of international trade exposed countries to new systemic risks. The impact of these risks is broader than the potential losses of individual traders, so they require regulatory intervention. These risks are mostly related to non-financial aspects of trade.

Disease has long followed trade routes, from pandemics of past eras to severe acute respiratory syndrome in more recent times. In an extreme example, the Black Death – a devastating global epidemic of bubonic plague that struck Europe and Asia in the mid-1300s – is believed to have been spread by trading ships.[22] In a similar but less severe case, an imported product caused the 2011 E. coli outbreak in Germany.[23] There is now an emerging evidence base that global trade is also linked to the rise of chronic disease in many low- to medium-income countries.[24]

Many of the risks associated with international trade may affect consumers, society and the environment, and require regulatory intervention (the Black Death is a rather extreme case of such risks). From a regulatory perspective, a shipment arriving at the border can be non-compliant with the requirements of several regulatory systems and thus be a source of various risks.

A shipment with agricultural products (fruits and vegetables), for example, which is essential for SDG 2 'zero hunger', can simultaneously pose a risk to local agriculture, if it contains dangerous pests. It can also be a health risk if the imported produce was treated with pesticides. The shipment can be used for smuggling other products, and its value can be incorrectly declared for the purposes of tax evasion. Most commonly, three different regulatory agencies will inspect such a shipment: customs authorities and the market surveillance departments of the ministries of health and agriculture.

Risks that require regulatory intervention can be grouped as follows:

- Customs and security risks
- Product non-compliance risks
- Sanitary and phytosanitary risks

International trade agreements and conventions address these risks. The WTO Trade Facilitation Agreement (TFA), the Agreement on Technical Barriers to Trade (TBT) and the Agreement on Sanitary and Phytosanitary (SPS) Measures describe principles and frameworks that countries can apply to tackle these risks without creating unnecessary barriers to trade or endangering consumers, society and environment.

Customs risks

The main risks inherent to the international trade framework are those with which the customs authorities deal. These risks include:[25]

- various types of commercial fraud
- counterfeiting
- smuggling of highly taxed goods
- drug trafficking
- stolen motor vehicles
- money laundering
- electronic crime
- intellectual or cultural property theft
- trafficking in endangered plant or animal species
- smuggling of arms or nuclear materials
- toxic waste or weapons of mass destruction

Risk management in customs has a long history, and using risk management techniques and information technology (IT) in this area is one of the trade facilitation principles described in the revised Kyoto Convention.[26] Customs authorities have identified the top risks as those associated with misdeclaration of value, smuggling of narcotics and misdeclaration of the product's Harmonized System (HS) code.[27] These risks are the main focus of the TFA, which says 'each Member shall, to the extent possible, adopt or maintain a risk management system for customs control'. Chapter 5 describes best practice in managing these risks.

Product non-compliance risks in the WTO Agreements

The second type of risks addressed in the TFA are those related to non-compliance of goods with technical, sanitary or phytosanitary regulations. Sectoral regulators manage these risks, and the TFA refers to border controls that aim to address these risks as 'other relevant border controls': 'Each Member shall concentrate customs control and, to the extent possible **other relevant border controls**, on high-risk consignments and expedite the release of low-risk consignments' (article 4.3).

The TFA does not provide any means of managing these risks. It merely states that when products are found to be non-compliant with technical regulations and standards, 'the Member [should] allow the importer to re-consign or to return the rejected goods to the exporter or another person designated by the exporter' (article 8.1). It adds that in case 'the importer fails to exercise it within a reasonable period of time, the competent authority may take a different course of action to deal with such non-compliant goods' (article 8.2).

The WTO Agreements on TBT and SPS address product non-compliance risks in greater detail.

The TBT agreement looks at technical regulations and non-compliance risks mostly from the potential trade disruption perspective.[28] Its main goal is much broader, however – namely, to ensure the application of the proportionality principle of regulatory requirements and compliance procedures to risk. The agreement requires that 'technical regulations are not prepared, adopted or applied with a view to or with the effect of creating unnecessary obstacles to international trade' (article 2.2).

To achieve this goal, article 2.2 of the agreement says risk management tools should be applied when designing technical regulations so they will not be 'more trade-restrictive than necessary to fulfil a legitimate objective'. It also requires that 'the risks non-fulfilment would create' are explicitly considered when regulations are developed.

Similar requirements cover the import compliance procedures followed by regulatory authorities at ports of entrance. Non-proportionate compliance procedures can compromise even most proportionate regulatory requirements, and the TBT agreement requires regulatory authorities to design compliance procedures so they are not 'stricter … than is necessary to give … the adequate confidence that products conform with the applicable technical regulations'.

'The risks non-conformity [with technical regulations and standards] would create' (article 5.1.2) should determine the degree of strictness of the compliance procedures, according to the agreement. At the same time, the TBT agreement says compliance procedures should be 'undertaken and completed as expeditiously as possible' and in 'a no less favourable order' for imported goods than for domestic products.

SPS-related risks

Similar logic with respect to designing regulatory requirements proportionate to risks is applied in the WTO SPS agreement, which covers risks arising from the entrance, establishment and spread of pests, diseases, disease-carrying organisms or disease-causing organisms.

The agreement has a separate article (article 5) entitled 'assessment of risk and determination of the appropriate level of sanitary and phytosanitary protection'. It states, *inter alia*, that 'members shall ensure that their SPS measures are based on an assessment, as appropriate to circumstances, of the risks to human, animal or plant life or health, taking into account risk assessment techniques developed by the relevant international organizations'. According to the agreement, testing, inspection, certification and approval procedures (including those applied at the border) are considered a part.

There are many examples of SPS-related risks, including one described in Baldwin and Weder di Mauro, 2020 involving the Grand Saint Antoine, a cargo ship from Lebanon loaded with expensive textiles. The ship, which had already come to the attention of the port authority of Livorno, reached the port of Marseille in 1720. The Health Commission had its doubts – the plague was widespread in the eastern Mediterranean.

Like all ships from affected regions, the Grand Saint Antoine was placed in quarantine. Normally, the crew and the property would have had to stay on board for 40 days to rule out the possibility of an infectious disease. But a textile fair near Marseille, where the importing merchants hoped for rich business, would soon begin. Under pressure from the rich traders, the health agency reversed its decision. The ship was unloaded and the crew went to town.

After only a few days, it became clear that changing the initial decision had been a mistake; the ship carried the plague. Now the disease spread rapidly. The authorities in Marseille were unable to cope with the number of deaths and corpses piled up in the streets[29].

Product non-compliance and customs risks

In many respects, risks of product non-compliance are similar to customs risks. Both types of risks are related to non-compliance with regulations and both are managed by regulatory authorities. At the same time, risk management best practice, including tools developed for customs authorities, should be adapted to the specifics of product compliance risks, as there are major differences between customs risk and risk related to the compliance of products with technical regulations and standards. These differences include:

- Product vs. shipment evaluation. Compliance with customs regulations (in terms of safety) is evaluated with respect to the whole shipment, whereas compliance with technical regulations can be determined only per product.
- Limited vs. unlimited number of risks. The number of customs risks associated with a certain shipment contains a very large but still limited and standard set of scenarios. Some compliance risks associated with one shipment, in contrast, depend on the quantity and variety of goods that the shipment contains. Theoretically, this number can equal all possible combinations of all non-conformities of all products to all regulatory requirements.
- 'Safe when compliant' vs. 'not necessarily safe when compliant'. When a shipment complies with customs regulations, it can be considered safe. As will be explained in Chapter 6, an item that complies with technical regulations and standards can still pose a risk to consumers. This fact often causes misunderstanding of the objectives of import compliance processes.
- Different nature of checks and associated costs. Opening a consignment is generally sufficient to determine if the shipment complies with customs regulations. This is most often not the case in product compliance: establishing conformity with technical regulations and standards requires even more sophisticated, costly and time-consuming conformity assessment procedures, such as lab tests.
- Different product groupings. Customs procedures and associated risks are structured around groups of products as they appear in the HS codes. Goods that belong to the same HS code are considered to have the same level of customs risk. In contrast, with respect to compliance with technical regulations, products that belong to the same HS code group can be very different in terms of the non-compliance risk.

The differences between these two types of risk should be considered when applying risk management best practice to import compliance procedures. However, the risk management principles outlined in the WTO Agreements are as relevant to product non-compliance as they are to customs risks.

Trade disruption risks due to border uncertainty

Trade disruption risks that occur in an international trade system are similar to operational risks for businesses. A broader definition of these risks includes all events related to inadequate or failed internal processes, people and systems.[30] Within an international trade framework, operational risks cover a range of events that might occur in 'procedures for importation, exportation and transit (including port, airport and other entry-point procedures)'.[31]

Operational risks in international trade, especially those associated with inadequate border compliance processes, or trade disruption risks lead to additional and – importantly – unexpected costs for exporters and importers. The impact of these risks cannot be underestimated: the cost of trade procedures, 'including customs and border-crossing procedures, amounts to 2%–15% of the value of the goods being traded.'[32] Operational risks not only boost these costs, but make them uncertain and unpredictable.

The average time of border compliance procedures remains very high in most of the regions of the world. This parameter is also associated with high levels of uncertainty, as the average time of border compliance differs widely from region to region and from country to country within one region.

Countries apply different measures to mitigate trade facilitation risks. Besides risk management, many trade facilitation measures seek to create transparent, predictable and straightforward procedures that expedite the movement of goods across borders and allegiate the operational risks of the international trade system. Trade facilitation measures can be thus seen as processes designed to reduce risks.

TFA provisions on the 'publication and availability of information' seek to reduce uncertainty for trade stakeholders by encouraging Members to publish in a 'non-discriminatory and accessible manner' information on procedures for importing, exporting and transit, applied rates, fees, rules for classification or valuation of products, etc. Reducing the complexity of import and export formalities minimizes the number of things that can go wrong. Border agency cooperation provisions promote coordination among authorities to minimize operational failures.

Trends driving non-compliance risks

Several trends explain the increasing level of uncertainty associated with international trade and the need for regulatory authorities, including those involved in border control, to manage risk more efficiently.

Growth in manufactured goods trade

Trade in manufactured goods has grown in the recent years while trade patterns have changed. Developing countries, for example, are no longer merely providers of raw materials, but increasingly import raw materials and intermediate goods to produce manufactured goods for export.

One result of this trend is a higher level of risk. Manufactured products are subject to more complex regulatory requirements than raw materials and thus are a bigger source of non-compliance risk. As manufactured products have a shorter path to consumers – they are placed directly on the market and are not processed by local industry, as is the case with raw materials – the consequences of non-compliance and the probability of an accident with non-compliant products are higher than in the case of raw materials.

Globalized production processes and trade diversification

Economist Michael Spence says global value chains – the complex network structure of flows of goods, services, capital and technology across national borders – are 'one of the lens' to analyse global economy.[33]

Global value chains have a strong impact on international trade patterns. Historically, new technologies and changing trade patterns have widened the circle of countries benefiting from expanding production. As countries' costs rise, production tends to move into more capital-intensive goods, with the more labour-intensive tasks moving to lower-cost locations offshore. Inomata and Taglioni suggest this trend may reverse due to automation in established manufacturing centres[34] and as businesses trade more and more in intermediate goods.

With regard to logistics expenditures, companies increasingly spend on transport and reduce expenditures on inventory holdings. This is because deliveries are often just in time[35] and waiting times at borders need to be minimized and predictable.

The new global value chains add to the complexity of the modern trading system. In the past, goods were often labelled as 'Made in country A'. This is no longer the case. Global production networks and trade in intermediary goods now constitute a larger portion of international trade, so goods produced or manufactured within the geographical boundaries of a country contain parts from different national locations. Despite globalization ambitions of a single, seamless global market with no trade barriers, in reality, today's era is one in which global trade is more complex and fragmented.

Regional integration and risk management

Regional integration brings many economic benefits. At the same time, it makes countries dependent on the import compliance systems of other member countries. There are five main types of regional economic integration models:

Most countries are part of regional integration schemes, and intraregional trade is growing faster than global trade in most parts of the world. The number of regional trade deals continues to rise, as does the number of such agreements incorporating trade facilitation measures. More regional trade agreements can lead to a spaghetti bowl of such accords, which require more certificates of origin to benefit from preferential tariffs and raise the level of uncertainty associated with a trade transaction. Obtaining and submitting certificates of origin is complicated and might be a source of uncertainty.

The benefits of integration include removing many supply chain barriers, such as non-tariff measures and border administration. At the same time, a country in a common market or customs union must rely on inspections that are made in another country.

Box 1 Five types of regional economic integration models

Free trade areas

No tariffs or quotas are applied between member countries, but each member maintains its own tariff barriers against third countries. Examples include the area of the former North American Free Trade Agreement and the ASEAN Free Trade Area.

Customs unions

No tariffs or quotas are imposed between member countries that jointly apply a common external tariff to third countries. Examples include the Southern Common Market, or Mercosur, and the East African Community.

Common markets

In addition to the free movement of goods, such as in a free trade area or a customs union, member states of common markets also agree on the free movement of labour, capital and services. Examples include the European Union (EU) and the Economic Community of West African States.

Economic and monetary unions

Harmonization of economic policies and adoption of a single currency. Examples include the West African Economic and Monetary Union and the EU's Economic and Monetary Union.

Total economic integration

Unification of monetary, fiscal and social policies and establishment of a binding supranational organization. The EU has achieved a monetary union and is now attempting to attain convergence in the fiscal and social policy domains.

Source: International Trade Centre (2017). *Charting a roadmap to regional integration with the WTO Trade Facilitation Agreement*. ITC, Geneva.

The efficiency of import inspections and risk management systems of the countries operating large ports of entrance within an integration scheme thus becomes crucial to all countries. Indeed, in many integration schemes, several ports of entrance and respective import compliance systems process large amounts of imported products. Compliance systems in these ports determine how many non-compliant goods are in a given country participating in an integration agreement.

New technologies

New technologies, such as IT tools, have made it easier to manage trade-related risks. At the same time, the development of new technologies has made products more complex – and often more dangerous when non-compliant than their older versions. An electric bicycle, for example, is more dangerous than a standard bicycle, and a cell phone is associated with more risks than a conventional telephone. Also, the development of new technologies makes it easier to introduce new goods on the market, which means greater risk.

Security challenges

Terrorism and security threats that can exploit the international trade system create more trade-related uncertainty. Counter-terrorist policies tend to multiply the impact of terrorism on trading costs. Inspections, monitoring and tighter security at airports and seaports increase the cost of travel for both tourists and business executives as well as shipping costs, especially when time is factored as a cost.[36]

Cybersecurity is another example of a key issue for trade policy. In the last few years, there have been many news reports about governments adding spyware, malware or similar programmes to computer-based products that are exported around the world. In the internet of things era, almost all goods can be connected to the internet, and most can also be used for spying and other malicious activities.[37]

The nature of international trade and the growing level of uncertainty mean all stakeholders – regulatory authorities as well as businesses – must apply risk management tools to systematically address all risks associated with trade. Greater uncertainty cannot be compensated by growth in resources; trade policy and safety objectives can be achieved only on the basis of systemic risk management.

How is risk managed at borders today?

Trade policy can address international trade risks

Trade policy is a systemic way to address the risks of international trade. Customs procedures, international trade agreements, trade restrictions on imported inputs, export finance and risk mitigation – elements of a trade policy described by the Organisation for Economic Co-operation and Development (OECD)[38] – can address many of the risks described above. The International Trade Centre's (ITC) *National Trade Policy Framework for Export Competitiveness*[39] also advises on the following instruments:

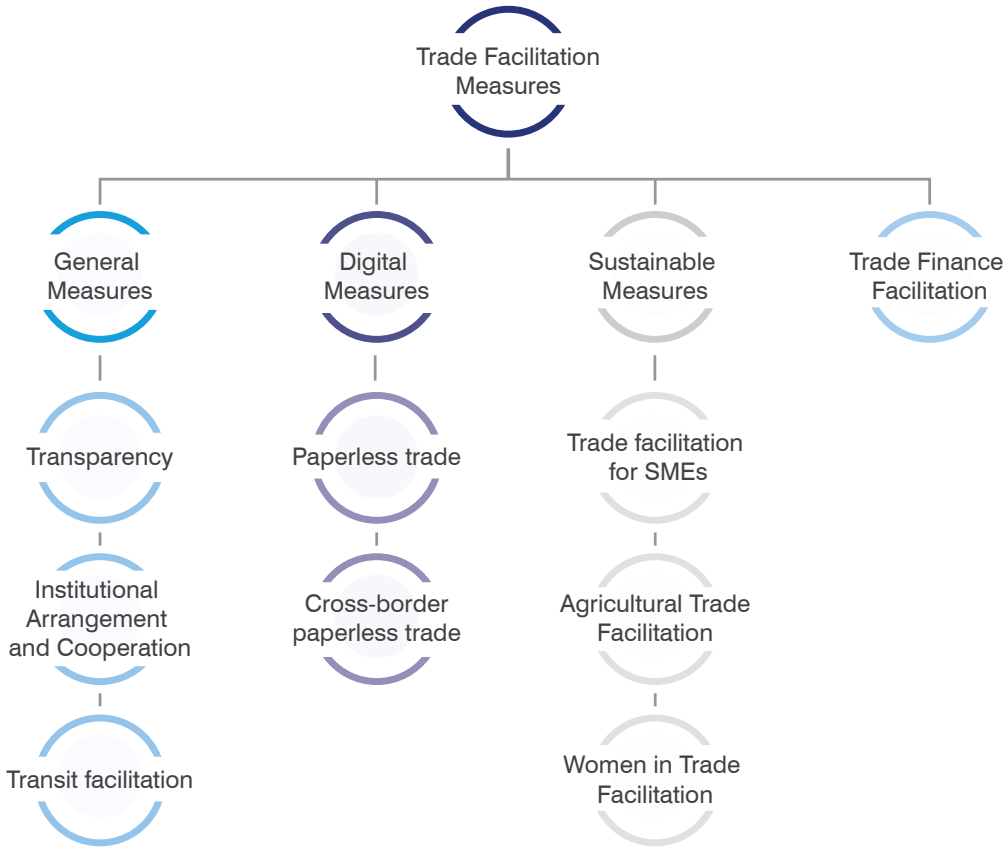
- Create competitive infrastructure services
- Promote export and foreign investment
- Move goods across borders effectively (i.e. facilitate cross-border trade)
- Address export market issues
- Improve inputs and capital goods

Trade facilitation as a policy measure

The importance of trade facilitation was recognized long before the 2030 Agenda was adopted in September 2015; many of the trade-related targets reflect earlier commitments included in WTO Agreements.[40] Over the past decade, substantial progress has been made to expedite trade and reduce trade costs. As tariffs were lowered or eliminated, reducing non-tariff sources of trade costs – such as inefficient transport, logistics infrastructure and services, and regulatory procedures (including documentary and border compliance) – has become the main method to facilitate trade.

The Trade Facilitation Agreement, ratified by 93.9% of WTO Members,[41] contains the most comprehensive list of non-tariff trade facilitation measures. Aimed at expediting the movement, release and clearance of goods across borders, these measures can be grouped into the following categories (such categorization is used in UN Global Survey on Digital and Sustainable Trade Facilitation):

Figure 3 How are trade facilitation measures grouped?



Source: Valentin Nikonov.

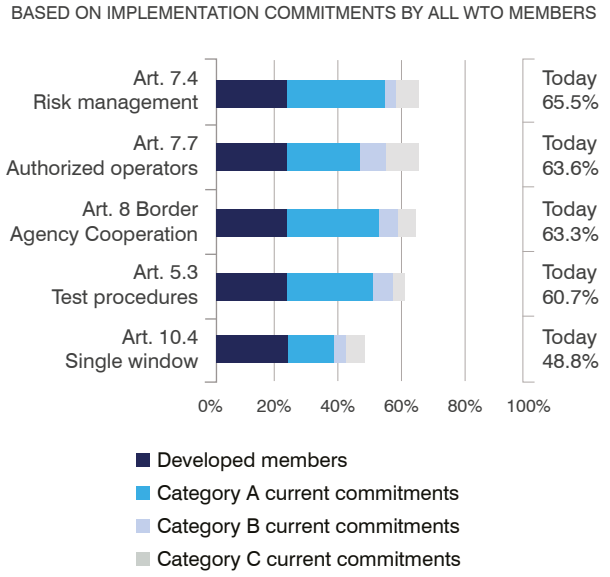
Applying risk management to border procedures

Risk management as a key trade facilitation measure

As a basis for deciding whether a shipment should be physically inspected or not, risk management is one of the key trade facilitation measures listed in the TFA. It belongs to the 'formalities' group.

Risk management is one of the five trade facilitation measures with the lowest implementation rates:

Figure 4 Bottom 5 measures with lowest implementation rate



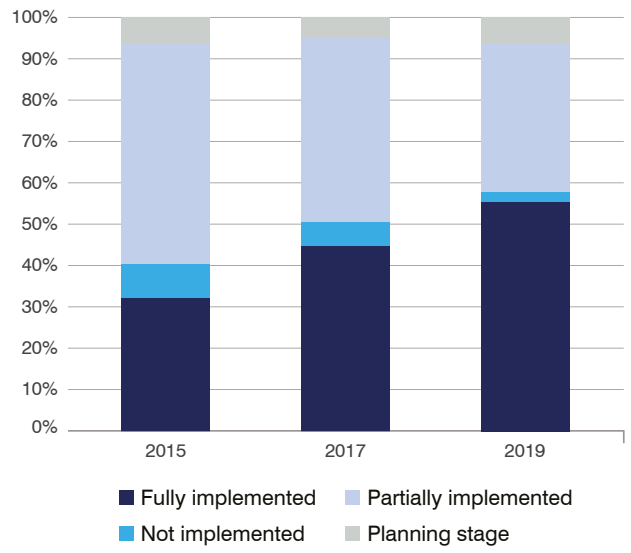
Source: WTO (2021). Available at https://tfadatabase.org/implementation/progress-by-measure

The WTO Trade Facilitation Agreement Database shows that as of June 2022, global implementation progress is evaluated as 65.5.%. Progress in managing risk depends heavily on the development status of Members.

All developed countries have reported fully implementing risk management systems to address the requirements of the TFA. However, progress among least developed countries, landlocked developing countries and developing members is only 30.7%, 45.2% and 64.4%, respectively (with 60.8%, 54.8% and 33.3% of future implementation commitments).[42]

Interestingly, according to the UN Global Survey on Digital and Sustainable Trade Facilitation, in 2021 risk management as a trade facilitation measure has the sixth highest implementation score in a list of 58 measures. The number of countries that fully implemented risk management as a trade facilitation measure grew steadily in 2015–2019.

Figure 5 Countries make progress on risk management (2015–2019)



Source: Valentin Nikonov, based on the UN Global Survey on Digital and Sustainable Trade Facilitation data. Available at https://www.untfsurvey.org/world.

Most countries (65) reported that they had 'fully implemented' risk management in border control procedures, while 37 countries 'partially implemented' this measure. Only nine countries were at the planning stage and three had not implemented the measure at all.

Streamlining processes through risk management

Successful implementation of risk management is supposed to minimize the time and cost of border compliance procedures, i.e. the time and cost of complying with customs regulations and regulations relating to other inspections that are mandatory for the shipment to cross a country's border, as well as the time and cost for handling that takes place at the port or border.[43]

Despite the high level of risk management implementation in border control (according to UN Global Survey data), analysis of the available import compliance data[44] shows that border compliance procedures need to be more efficient. In 2015–2020, for example, border compliance procedures took more time in seven countries – five of which had reported fully implementing risk management. Compliance times in 76 countries – 43 of which said they had fully implemented risk management – were unchanged.

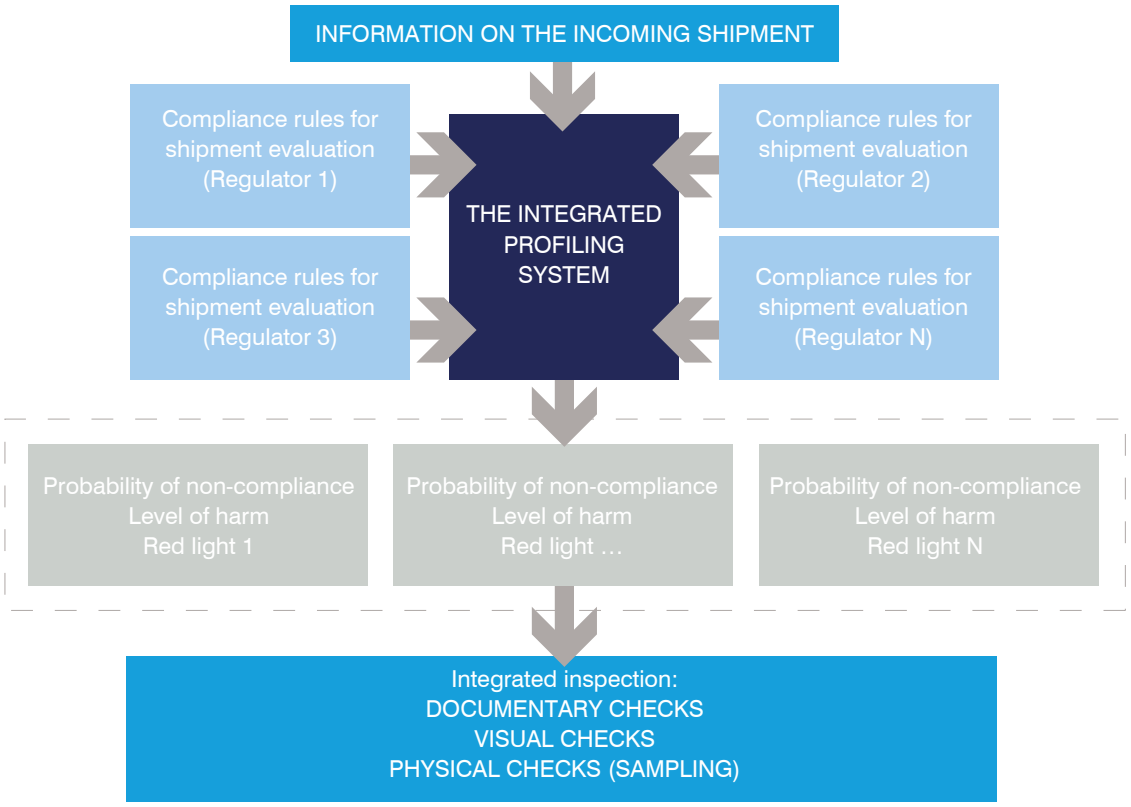
Challenges in implementation

UNECE needs assessment reports from 2012–2020 include several examples showing why risk management implementation has not yet had a substantial impact on time of border compliance procedures. Reports on Armenia[45] and Georgia[46] highlight the need to strengthen and improve risk management systems and techniques at the border. The report on Moldova[47] calls for a thorough review of the risk parameters and profiles in the customs integrated information systems, and urges a greater emphasis on risk management when choosing approved economic operators.

Albania[48], Belarus[49], Kyrgyzstan[50] and Tajikistan[51] need to consolidate 'risk-based control management system and techniques' applied at the border. In the case of Belarus, introducing a coordinated approach to risk management at the border was highlighted. Kyrgyzstan was advised to 'establish a link between the individual agencies' risk management system and that of the [Unified Automated Information System], as the latter has established itself as the backbone of Kyrgyzstan's broader risk management system' and to 'review the risk management system' as a whole.

Tajikistan should establish a 'common risk management policy' that would 'articulate a common conceptualization of risks and capture the fundamental aspects of risk management as they apply to all border control agencies' and contains principles necessary for 'fostering border

Figure 6 Reference model of an integrated risk management framework



Source: UNECE (2021). Recommendation V on 'Addressing product non-compliance risk in international trade'. Available at https://unece.org/sites/default/files/2022-04/Recommendation_V_E.pdf.

control cooperation'. It also is urged to identify 'areas that could benefit from improved coordination and integration to ensure successful implementation of integrated border management'.

The overview of the needs assessment studies stresses the general importance of strengthening risk management[52] with a 'comprehensive information system' to support risk identification, risk evaluation, the creation of risk profiles and other essential functions of the process to enable customs exchange information.

The OECD says that 'on balance, risk management efforts seem to have stalled at the single-agency (customs) stage and have yet to achieve their full potential' and that 'making risk management more comprehensive and integrating […] input from all border agencies could bolster efficiency at the border and further sustain interagency cooperation'.[53]

A World Bank analysis[54] shows similar results: 'Customs is only one of the agencies involved in border processing, and evidence suggests it is often responsible for no more than a third of regulatory delays.' Traders are far more satisfied with the performance of customs than other border management agencies.

Integrated risk management as a national strategy

A national risk management strategy for border control is needed to address the challenges described above. Such a strategy is based on the following principles:

- Applying formal and standardized methodologies to manage non-compliance risk in border control agencies;
- Strengthening the role of import compliance procedures in market surveillance and enforcement systems run by regulatory authorities responsible for product compliance;
- Integrating import compliance processes applied at the border with other building blocks of respective regulatory systems to ensure that these processes support all regulatory goals and respective SDGs;
- Ensuring efficient **integration of risk management processes** of all regulatory agencies involved in border control; when appropriate, on the basis of existing risk management frameworks of the customs authorities;
- **Integrating risk management in border control with other trade facilitation tools**, such as the single window.

The risk management strategy described above, which aims to facilitate trade while protecting the health and safety of consumers, society and the environment by removing redundant and sequential controls, has the following benefits:

- From the international trade perspective, it supports and even leads to more efficient implementation of the risk management principles of the WTO Agreements, in particular the TFA, TBT and SPS agreements.
- It introduces and highlights the concept of a non-compliance risk. This is essential to ensure that the controls of every agency involved in import compliance support regulatory objectives and are prioritized according to both the severity of the consequences of product's non-compliance with relevant regulations, i.e. their impact on regulatory objectives, and the probability that an incoming shipment contains a non-compliant product.
- By identifying non-compliant products at the border, it ensures more efficient enforcement.

Integration directions of the strategy provide for the most efficient application of risk management in border control and ensure application of holistic approach in the design of an import compliance framework, which is essential for collaborative border management (the concept is described in World Bank, 2011).

An integrated approach – which in most cases implies integrating the risk management processes of regulatory agencies into the risk management system of customs – provides for a comprehensive overview of risks. It also allows the functioning of an import compliance framework to be analysed as a whole, using overall border compliance time as main evaluation metrics.

Finally, an integrated approach helps ensure the efficiency of risk management at the border, as it:

- Creates a common risk management language and processes at the border to define risk tolerance and manage non-compliance risks, among others;
- Leads to more efficient cooperation among regulatory authorities, allowing consideration of correlations among risks and findings of agencies involved in border control, use of common data models and cooperation to develop risk profiles and compliance rules;
- Saves resources of regulatory agencies by allowing regulators to share risk management expertise, IT infrastructure and software tools and processes when they develop and apply risk profiles and target non-compliance shipments. All types of non-compliance risks of incoming shipments can be evaluated in one system based on integrated data sources.

The biggest challenge of this strategy is the complexity of the projects needed to implement it, as the strategy covers different aspects of border control and brings together several standalone areas. Implementing this strategy requires running a portfolio of projects whose structure would depend on the risk management maturity of the existing framework, both in terms of the individual capacity of participating agencies and the integration processes.

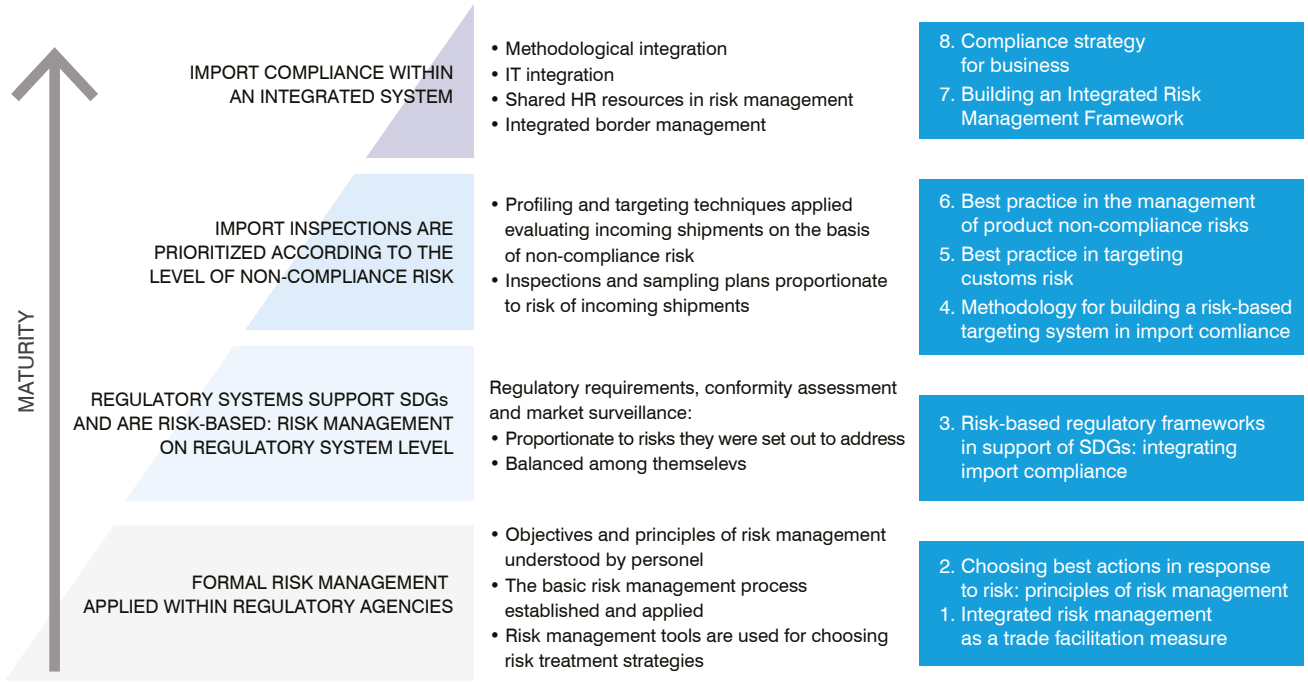
Charting a roadmap for implementation

The roadmap to build integrated import compliance systems at the border can be easily derived from the strategy described above and contains the following layers:

1. Organizational level: Implementing formal risk management within regulatory agencies;
2. Regulatory system level: Ensuring that relevant regulatory systems support SDGs and are risk-based;
3. Import compliance level of a regulatory agency: Applying profiling and targeting techniques in regulatory agencies responsible for border control to evaluate the non-compliance risk of incoming shipments;
4. Integration level: Integrating import compliance systems of regulatory agencies involved in border control.

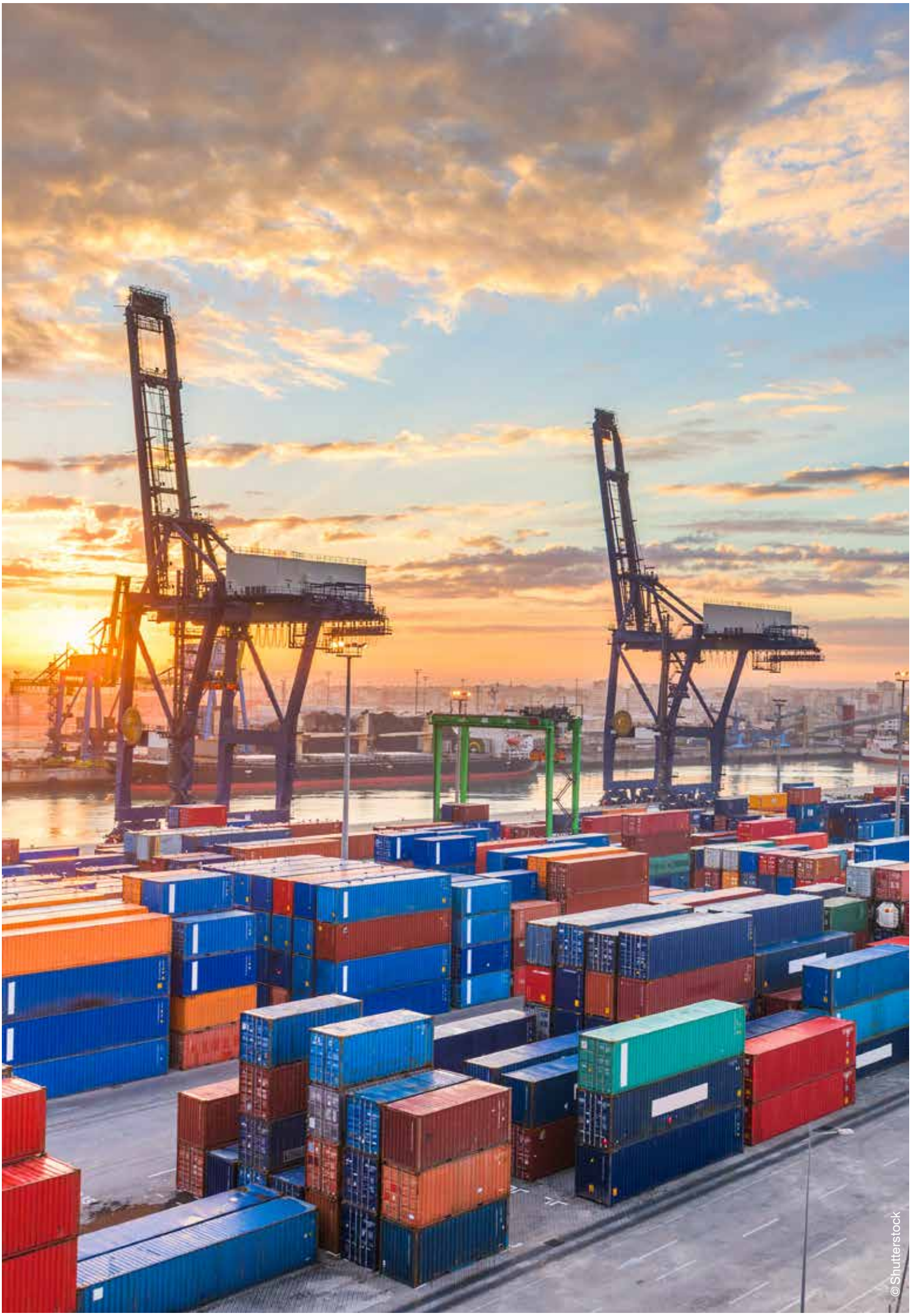
The implementation roadmap is presented below a pyramid, which can also be used as a maturity model to evaluate the level of integrated risk management at the border. Going bottom-up in the pyramid, every step in the roadmap can be skipped if it is already implemented within a border control framework.

Figure 7 Implementation roadmap: Integrated risk management maturity model



Note: The right part of the figure shows the titles of the chapters of the guide supporting each phase of the implementation roadmap.

Source: Valentin Nikonov (2020). Presentation made at the MARS and GRM joint experts group meeting. Available at https://unece.org/info/Trade/WP.6-Meetings/events/17825.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Chapter 2

Risk management principles in trade

Risk management principles in trade

All regulatory stakeholders involved in international trade must apply a formal risk management methodology to manage risks successfully and to build an integrated import compliance system for border control. This chapter highlights the difference between intuitive and formal risk management and provides an overview of the main tools that can be used to manage risks in the context of international trade and import compliance. It also analyses the risk management principles of the trade agreements that form the basis of an import compliance framework and offers guidance on choosing appropriate risk treatment strategies.

Formalizing risk management in trade

Humans invented the concept of 'risk' to help them understand and cope with the dangers and uncertainties of life.[55] These dangers include those associated with trade, and – as was shown in the previous chapter – international trade and risk management share a long history. Although traders and regulatory authorities started managing risks thousands of years ago, in most cases this was done intuitively. As intuitive management of risks was not based on any formal methodology, this often led to serious errors.

Intuitive and non-systemic risk management can lead to biases in risk perception and hence to wrong policy and regulatory responses. Tversky and Kahneman describe biases associated with intuitive judgement of probability – the central parameter of any risk – in 'Judgment under Uncertainty: Heuristics and Biases'.[56] The paper shows how people err in intuitive evaluations of probabilities because they substitute probability with other heuristics. The authors describe situations in which people assess the probability of an event by the ease with which instances or occurrences can be brought to mind – which, of course, causes errors.

These biases are as relevant to import compliance as they are to any other field. If an inspector, for example, encountered two shipments from country A that were non-compliant (or read about them in a newspaper), he or she might overestimate the probability of non-compliance of shipments from this country. Other errors in intuitive evaluations or risks stem from the fact that people often assess the probability by the degree to which an object represents, or is similar to, a stereotype. The paper describes other biases, including insensitivity to sample size and predicting solely in terms of the favorableness of the description.

Applying formal risk management methodologies helps avoid errors in risk perceptions. Managing risks in such a complex and multilayered system as international trade requires application of formal and harmonized risk management methodologies. International standards on risk management, such as ISO/IEC 31000 and ISO/IEC 31010, became the basis of risk management frameworks developed by international organizations working in different fields, such as the World Customs Organization (Risk Management Compendium) and UNECE (Risk Management in Regulatory Frameworks: Towards a Better Management of Risks).

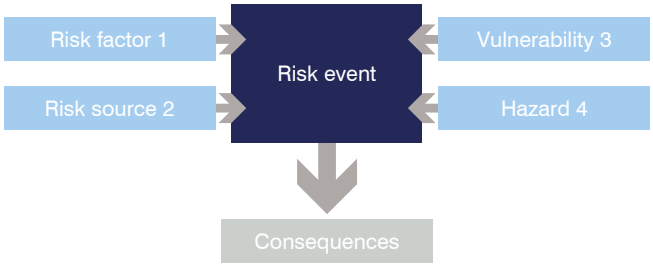
Certain concepts of risk management help avoid risk perception biases and are essential for regulatory authorities involved in international trade and border control.

How to identify a risk?

Risks are often confused with risk events, such as 'shipment is non-compliant' or 'shipment will be stuck at the border'. The internationally recognized definition of risk is 'effect of uncertainty on objectives'.[57] This definition shows that identifying only a risk event is inadequate; formal identification requires evaluating the level of uncertainty associated with the event (its probability) and the impact that this event will have on the objectives in case it occurs.

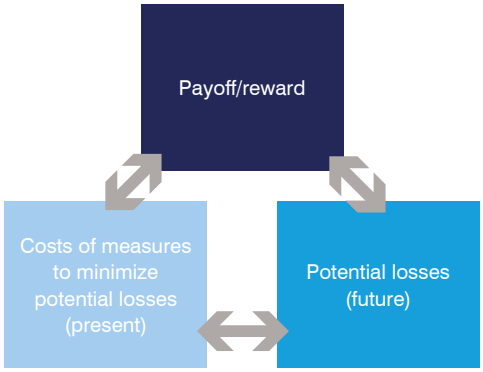
To avoid many of the risk perception biases, risk must be described in terms of risk sources, potential events, their consequences and their likelihoods.[58] One way to describe a risk that is commonly used in practice is to develop a graphical representation that shows how uncertainty affects objectives as a cause–effect logic.

Figure 8 Structure of a risk



Source: Valentin Nikonov (2020). Presentation made at the MARS and GRM Joint Experts Group meeting, Available at https://unece.org/info/Trade/WP.6-Meetings/events/17825.

Figure 9 Objective of risk management: Finding the right balance



Source: Valentin Nikonov. Picture prepared to illustrate the methodologies described in the guide.

Identifying a risk includes formalizing:

- An uncertain event: something that may occur in the future about which we are uncertain (or an event that could have happened in the past, but about which we lack precise information – such as whether it did happen or important details about the event);
- The likelihood of the event (to happen in the future or having possibly occurred in the past);
- The impact of the event on the objectives;
- A set of risk factors (vulnerabilities or hazards) that can cause the event.

Goals and processes

Risk management is a set of coordinated activities to direct and control organization with regard to risk.[59] In the context of import compliance and trade facilitation, risk management objectives can be defined as helping a regulatory stakeholder achieve its goals by choosing and taking the best actions in response to risks.

The best actions in response to risks are those that enable the regulatory authority to find the right balance between three parameters: the reward associated with achieving the objectives, the potential impact of the risk (often best described as 'losses') and the cost of actions chosen to address the risk (often described as 'safety measures'):

These three parameters are interrelated in the following way. The 'reward/potential losses' relationship is key in risk management. Typically in business (and also gambling!), the more ambitious the objectives (the higher the stakes), the higher the potential losses associated with the activities undertaken to achieve these objectives. Similarly, in the international trade context, rewards associated with increased trade volumes can lead to higher levels of losses associated with non-compliance.

The 'costs of actions aimed at modifying the risk/potential losses' relationship can differ depending on the type of risk. In general, however, potential losses are proportionate to risk mitigation costs: the higher the cost of risk mitigation measures, the lower the potential losses.

The costs of risk mitigation measures affect the reward expected from the main activities: higher risk mitigation costs lead to a lower reward.

The risk management process, essential to achieve the risk management objectives, calls for the implementation of the following functions:

- **Establishing the context** or knowing what we are 'protecting' – our strategy or assets, public health, market efficiency, etc. – and knowing our stakeholders.
- **Identifying the risks** (what events might occur, why might they occur, how probable are they and what impact could they have) and being familiar with as many of them as possible.

- **Understanding the risks** that are the most important for us, which is why we assess and evaluate them.
- Starting with the most important risks, **choosing a risk treatment option** (we can retain the risk, share it with another party or mitigate/avoid it by removing its source).
- **Implementing whatever decision has been taken**, which is the direct result of the risk management process.
- **Devising a crisis management plan** for risks that are accepted and those that are mitigated. This results in an action plan for dealing with the risk, should it occur. It is a very important conceptual stage in the risk management process, as risk management is a tool to achieve adequate, but not absolute, safety.[60]

Chapter 3 describes how these functions can be performed to build a regulatory system.

Risk treatment strategies: Choosing the best actions

Risk management methodology is universal and can be applied by any organization (or person) to any type of risk. In many cases, risk management supports the main activities of an organization by lessening the impact of uncertainty on its objectives and business processes, as well as by creating environment in which advantage can be taken of new opportunities that arise.

At the same time, the risk management process is at the heart of the main activities of some organizations, such as banks, insurance companies and border compliance agencies. Risk management is one of the main business processes in these organizations and an important part of the services they provide.

In either case, best actions in response to any risk can be chosen from the following list of risk treatment strategies. These strategies can be applied both to address the internal risks of an organization and the risks that the organization manages as part of its main business processes.

Risk treatment strategies represent possible 'directions' for dealing with risks and offer four options:

- Modifying a risk
- Tolerating a risk
- Avoiding a risk
- Transferring a risk

Modifying a risk

Modifying a risk is the key strategy of risk management. It seeks to minimize the likelihood and the consequences of a negative risk event and maximize the likelihood and the consequences of a positive risk event (an opportunity). Although in many contexts – and especially in organizations that seek to establish safety – risks are considered as 'negative' events, modern risk management approaches are based on the concept that uncertainty can also have a positive impact on objectives that also should be addressed.

The following approaches can be used to modify risks:

- Changing the likelihood of the risk event by removing the risk factors and/or other means;
- Changing the consequences of the risk event.

Issuing import permits, auditing businesses and performing border inspections are some of the activities of regulatory authorities that aim to modify the non-compliance risk of products. Importers, for instance, may choose a more efficient shipping company to remove the risk factor 'possible loss or damage of goods'.

Risk	Risk mitigation strategy
Importer risk: goods spoil during transport	Choosing a more efficient shipping company
Regulator risk: proliferation of non-compliant products	Establishing border controls

Risk mitigation includes treatments that minimize negative consequences of risk events (if they occur) and/or the probabilities that these risk events will occur (synonyms include 'risk elimination', 'risk prevention' and 'risk reduction'). Common approaches to risk mitigation, along with removing risk factors described above, include diversification and hedging. Another way to modify the risk is to change the consequences of the risk event.

In general, all actions carried out with the goal of modifying a risk are referred to as controls, and costs associated with them are often referred to as risk mitigation costs or safety costs. Depending on the context in which risk management is implemented, these controls can include adopting projects or processes within a company, or developing new policies and regulations within a regulatory system.

Tolerating a risk

Accepting risks implies 'retaining the risk by informed decision'. If this strategy is applied, the economic operator will not do anything about the risk that goods can be damaged during transit: it won't bear the costs associated with the actions aimed at minimizing the potential losses.

Risk	Risk acceptance strategy
Importer risk: loss of goods in transport	Not changing the shipping company (investing the money saved into something else)
Regulator risk: proliferation of non-compliant products	Abolishing import inspections (minimizing border compliance time)

Transferring a risk

Transferring a risk, or risk sharing, 'involves the agreed distribution of risk with other parties'. In a business context, the common approaches used to apply this strategy include insurance and outsourcing.[61] In the first case, the risks are shared with an insurance company. Outsourcing, on the other hand, implies sharing the activity that contains the risk with another party. Below are two examples of how this strategy can be applied.

Risk	Risk transferring strategy
Importer risk: loss of goods in transport	Buying insurance
Regulator risk: proliferation of non-compliant products	Transferring the risk to business companies

Avoiding a risk

Risk avoidance does not seek to modify the parameters of the risk itself. Instead, it focuses on the activities that contain the risk. Potential losses associated with a risk event can be avoided 'by deciding not to start or continue with the activity that gives rise to risk'.[62]

How to apply the risk avoidance strategy for the risk event 'goods damaged during transport'? Not importing goods will guarantee that they are not damaged during transit (the risk will be avoided). In this scenario, the importer will not have to invest in the safety of goods in transport at all, but the objectives of the activity that contains the risk and associated rewards will not be achieved.

Risk	Risk avoidance strategy
Importer risk: loss of goods in transport	Not importing goods
Regulator risk: proliferation of non-compliant products	Banning the imports

Criteria for evaluating risk treatment strategies

Good risk management results in best actions to respond to risks. One of the strategies shown above can treat any risk. When risk treatment strategies are properly chosen and applied, they allow 'making the best out of the uncertainty' by preparing for its possible impacts so they will not prevent – or will even support – achievement of the objectives.

Considering the relationship among the three parameters is crucial for selecting the best response to risks.

Table 2 Criteria to choose risk treatment strategies

Strategy	Situations where it is a best response	Situations where it is not the best response to risk
Modify (mitigate) a risk	Optimal way to mitigate the risk is chosen Cost of risk mitigation is proportionate to potential losses Risk mitigation brings the risk to the desired level	The residual risk remains too high Mitigation costs exceed the reward associated with the main activity (or are not proportionate to the reward)
Accept the risk	There is no way to modify the risk efficiently (e.g. emerging risks) The business wants to accept the risk The stakes are high enough	The level of the accepted risk is higher than the actual level of risk that the business is willing to accept
Avoid a risk	Risk that is not tolerable that cannot be modified and thus brought to the required level Risk mitigation costs exceed the reward from the main activity	There are proportionate risk mitigation measures Risk avoidance chosen because of the risk perception biases (fears)
Transfer a risk	An optimal strategy compared to risk mitigation	Will create higher risks

Source: Valentin Nikonov, table prepared to illustrate the methodologies described in the guide.

Risk management principles in the WTO Agreements

The risk management objectives of any regulatory authority involved in border control can be defined as finding balance among the following parameters:

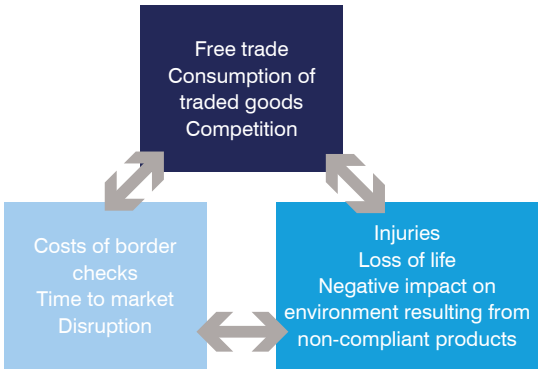
- Potential losses associated with non-compliance risks and customs risks. These losses typically include impact on the health and life of consumers (injury or loss of life), as well as the impact that non-compliant products may have on the environment and other societal objectives.

- Investment to build a border compliance framework and associated costs to carry out checks and inspections (e.g. costs for a laboratory to check products). From a regulatory system perspective, time and money spent on checks by both regulatory authorities and businesses, as well as in terms of disruptions of the trade process and other impacts that these measures have on supply chains, can be presented as 'safety costs' that are supposed to minimize potential losses associated with international trade.

- The anticipated payoff, in turn, can be expressed in terms of the benefits associated with trade, consumer satisfaction, market competition and other categories.

Ensuring the right balance between the potential losses associated with incoming shipments and costs of border compliance requires prioritizing import inspections on the basis of non-compliance risk. Risk management in border control is a priority-setting tool that allows concentrating on high-risk shipments and expediting the release of low-risk shipments. Successfully managing product non-compliance and customs risks is itself a risk mitigation measure that helps minimize trade disruption risks.

Figure 10 Risk management objectives in import compliance



Source: Valentin Nikonov (2018), presentation at the UNECE Group of Experts on Risk Management in Regulatory Systems webinar.

Analysis of the WTO Agreements shows that many of their principles aim to manage trade-related risk. The TFA, TBT and SPS agreements set out important principles of sound risk management that regulatory authorities dealing with safety risks at borders (and generally) should apply. These principles include:

- **Proportionality of regulatory requirements:** Technical regulations and standards, along with other regulatory requirements, should be proportionate to risks that a product might pose to consumers, society, the environment and other areas of the country's security (TBT and SPS);
- **Proportionality of compliance procedures:** Compliance procedures that are introduced by regulatory authorities to identify products that do not meet the requirements of regulations should be proportionate to risks that a non-compliant product might create (TBT and SPS);
- **Systemic risk management:** Regulatory authorities should develop and maintain a risk management system to manage non-compliance risks (TFA);
- **Principles of tolerable level of risks:** Regulators should concentrate controls on high-risk consignments so the release of low-risk consignments 'could be expedited' (TFA);
- **Principle of prioritizing inspections based on risk:** To identify high- and low-risk consignments, regulatory authorities should develop 'appropriate selectivity criteria' so a person or a consignment for checks is selected in a risk-based manner. These selectivity criteria, according to the agreement, could be based on the Harmonized Commodity Description and Coding System (HS code), nature and description of the goods, country of origin, country from which the goods were shipped, value of goods, compliance records of traders, and other parameters (TFA);
- **Principle of 'uniform flexibility':** Though the TFA states that 'each Member shall apply common customs procedures and uniform documentation requirements for release and clearance of goods', it recognizes that this 'shall not prevent Member from differentiating its procedures and documentation requirements for goods based on risk management'.[63]

Zero risk is not a risk management objective

Risk management is not only about minimizing risks – it is about making them tolerable. In other words, high risk is acceptable if it meets the risk tolerance level of a regulatory stakeholder.

Risk tolerance is 'readiness to bear the risk after risk treatment in order to achieve its objectives'.[64] Regulatory requirements can influence risk tolerance in a business environment; for a regulatory authority, societal expectations affect risk tolerance.

Another important conclusion that follows from the goal of risk management is that zero risk is not and cannot be a valid objective. This is the case not only because uncertainty will always be present and new unknown risks will emerge, but also because the likelihood and the impact of risks cannot be brought to zero, even if the most expensive risk treatment measures are implemented. Also, mitigating risks creates new risks.

The absence of zero risk can be also explained by referring to the balance between the level of risk, reward and the cost of safety measures: if bringing risks to zero were feasible to get a reward, it would create a 'money machine'.

Determining which level of risk is tolerable is very complicated. It might depend on personal, cultural, societal or even political factors. In many cases, such a decision cannot be judged in terms of 'right or wrong'. One outcome of risk management undertaken by a regulatory authority is deciding the acceptable level of risk associated with business processes, products and services within the scope of its activities. Regulatory requirements are supposed to bring the level of risk of a compliant product to the level that a regulatory authority is willing to tolerate.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Chapter 3

Regulatory systems support sustainable development goals

Regulatory systems support sustainable development goals

This chapter shows how risk-based regulatory systems support the SDGs. It provides guidelines on building risk-based regulatory frameworks that are grounded in the risk management principles described in Chapter 2.

Creating risk-based regulatory systems is essential for efficient border control. This is because import compliance is an indispensable part of a market surveillance system, which, in turn, is one of the building blocks of any regulatory framework. For import compliance to be efficient, it should be balanced with other elements of a regulatory framework.

Non-compliance risks

Regulatory systems supporting the SDGs contain regulatory requirements for goods and services, produced and traded by economic operators. A food safety regulatory framework, for example, contains regulatory requirements for the allowed level of pesticides in fruits and vegetables, health safety systems establish compliance of medical devices and regulate the use of medicine, and environmental protection frameworks contain requirements on emissions.

Applying international best practice in risk management and referencing international standards in regulations is an important prerequisite to ensure the proportionality of regulatory requirements. From a risk management perspective, regulatory requirements aim to bring the level of risk associated with a certain product – to SDGs and other regulatory objectives – to a tolerable level.

If regulatory requirements are proportionate to the risks they were set out to address, the risk level associated with compliant goods does not exceed a tolerable level of risk, whereas each non-compliant product placed on the market poses a risk and requires a regulatory response. Examples of risks to SDGs described above are all related to different types of product non-compliance.

Conformity assessment as a form of pre-market control seeks to minimize risks to the SDGs by not allowing non-compliant products to be placed on the market. Regulatory authorities can choose different conformity assessment procedures for goods depending on their level of risk.

Examples of conformity assessment procedures include self-declaration of conformity for low-risk products and product certification provided by an independent body for those of high risks. All conformity assessment tools aim to ensure that production processes and products themselves meet regulatory requirements, and that non-compliant goods are already identified at the premises of an economic operator.

Market surveillance processes, as a form of post-market control, complement conformity assessment in minimizing the risk of non-compliance by inspecting products and services that are already on the market. Market surveillance aims to remove non-compliant goods from the market and minimize the risks that such products pose to consumers, society and the SDGs.

Turning the SDGs into regulatory goals

SDGs and regulatory system objectives

Setting regulatory objectives is the first step to build a risk-based regulatory system. The targets of the SDGs form the basis of the objectives of any regulatory system. To identify clear regulatory objectives and develop a sound implementation strategy from a regulatory and operational perspective, the SDGs and their targets should be analysed in the national and international contexts. The relationship among regulatory systems and SDGs is ‘many-to-many’ – in other words, every regulatory framework can be linked to several SDGs and targets, and any SDG and target can be addressed by several regulatory systems.

Table 3 SDGs and the objectives of different regulatory systems

SDGs and targets	Objectives of food safety regulatory framework	Objectives of transport regulatory framework	Objectives of agricultural regulatory system
End poverty in all its forms everywhere	Ensure the availability of food for poor and vulnerable.	Ensure availability of transport for the poor and the vulnerable. Create working places.	Resilience to shocks (climate and economic).
	Support creation of workplaces.		
End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	Increase trade in food.	Ensure efficient transport of food products.	Support new farms and economic operators in agriculture.
Ensure healthy lives and promote well-being for everyone at all ages	Safety of food. Safety of imported food.	Reduce emissions.	Reduce the use of pesticides.
Ensure inclusive and equitable quality education		Transport to schools.	Support education in agriculture.
Achieve gender equality and empower all women and girls	Ensure gender equality in regulated businesses.		
Ensure access to affordable, reliable, sustainable and modern energy for all	Ensure sustainable use of energy in the regulated businesses.		

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

The objectives of the regulated economic operators are another important input into the goals of a regulatory system.

Embedding business objectives in regulatory goals

It is generally accepted that the objective of economic regulation is to prevent market failures. In a broader way, the objectives of a regulatory system can be described as follows:[65]

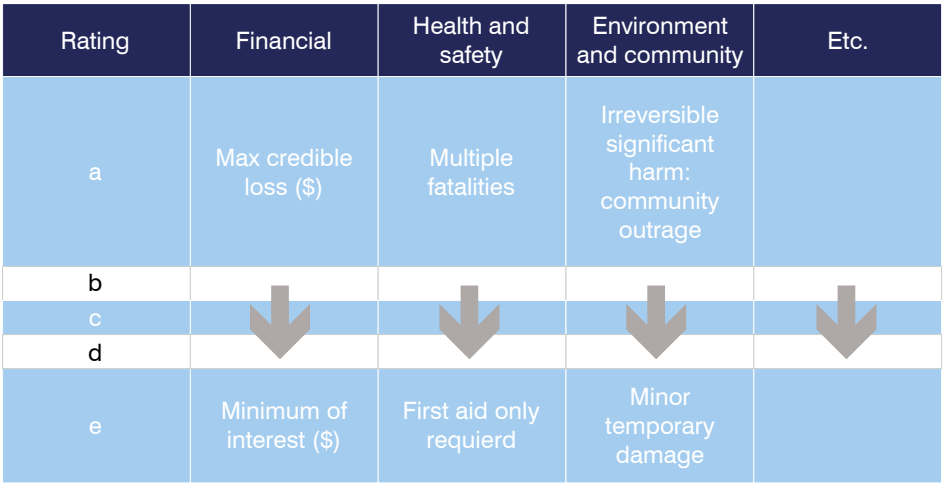
1. To promote growth, innovation, competitiveness and job creation without creating unnecessary risks to welfare, safety, public health and environment;
2. To protect public health, welfare, safety and environment without stifling growth, innovation, competitiveness and job creation.

Promoting growth, innovation and competitiveness requires creating market conditions that help businesses reach their goals. The objectives of regulated firms are therefore an important input for setting the objectives of a regulatory system. Profitability objectives of an economic operator, for example, can be transformed into 'ensure market efficiency' on the regulatory system level. Indeed, growth and innovation always comes from business; in a sense, regulators rely on businesses. It can be argued that a company can survive without regulation, but it is certain that regulation will not be needed if there is no one to regulate.

SDGs for developing risk evaluation criteria

From the risk management perspective, regulatory objectives are essential to define risk criteria, necessary to consider how likelihood and consequences (both positive and negative) will be defined and measured.[66] Risk criteria constitute parameters that could be used to evaluate the significance and the level of tolerability of risks, against which risks can be evaluated. Objectives can be turned into 'risk criteria' using the following scheme as a guideline to categorize the consequences, though instead of 'financial', 'health and safety', etc., objectives of a regulatory system should be applied:

Figure 11 Categorizing risk consequences: A consequences scale



Source: International Electrotechnical Commission (2019). IEC 31010:2019 Risk management – Risk assessment techniques.

The following example illustrates one possible outcome of this approach. Each objective of the food safety regulatory system can be turned it into a scale according to which the impact of uncertainty on this objective will be measured.

Table 4 Ways to establish risk criteria based on regulatory objectives

Scale/ Objectives	Ensure the availability of food for poor and vulnerable	Increase trade in food	Ensure safety of food	Efficiency of economic operators	Impact on SDGs
Severe consequences	Food is/becomes unavailable to large populations of poor and vulnerable	Trade falls by more than 50%	At least one victim	More than $100,000 in additional costs for economic operators	Heavy impact on an SDG
Moderate consequences	Food is/becomes unavailable to fewer than half of the poor and vulnerable groups	Trade falls by less than 50%	Poisoning involving more than 20 consumers	Additional costs of $10,000 – $100,000	Moderate impact on an SDG
Low consequences	Several cases, when food is unavailable/no growth	No growth in trade	Poisoning involving fewer than 20 consumers	Additional costs of less than $10,000	No impact on SDG

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

The table is based on a three-layered scale of severity that measures the consequences of risks across all regulatory objectives. Severe, moderate and low impacts on every objective should be determined to build comprehensive risk criteria. The scale of consequences can include as many layers as regulatory authority may want.

Risks to achieving the SDGs

The objective of risk identification

Risk identification aims to find, recognize and describe risks that may help or prevent achieving the objectives of a regulatory system. Using all the available relevant and up-to-date information is important to identify risks. Risk identification should result in a formal document that provides regulatory authorities with answers to the following question:

- What events might occur that will affect regulatory objectives?
- What impact will these events have on all the SDGs?
- Why might these events occur?
- How probable are they?
- What factors make these events more or less likely?

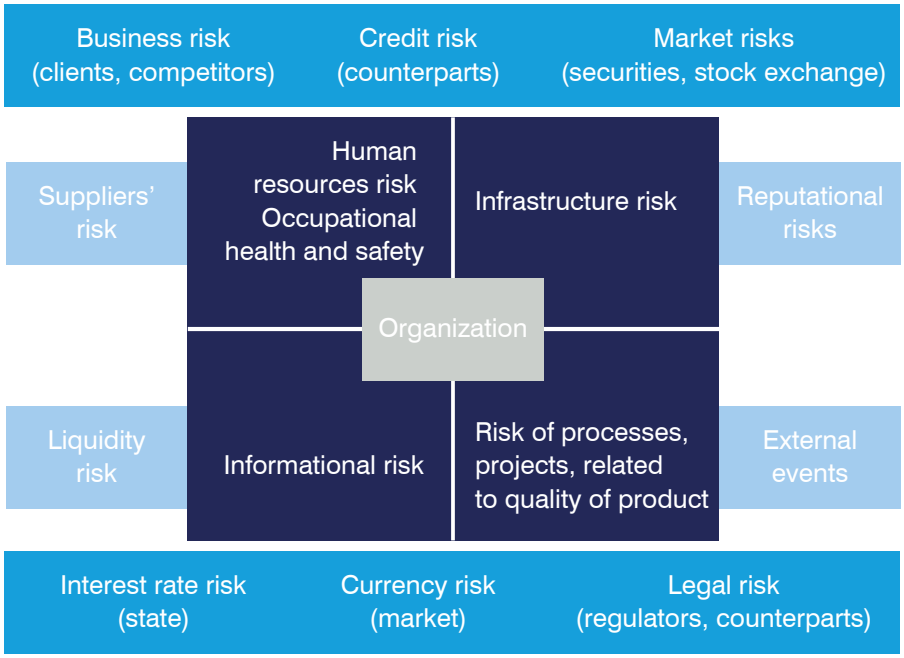
Regulatory authorities can use various tools to ensure that risk identification is timely and comprehensive.

Developing taxonomies

Developing a checklist with all known types of risks and using it to identify risk can help ensure that no group of risks is omitted. Checklists can be used to assess risk in various ways, such as to assist in understanding the context, in identifying risk and in grouping risks during analysis. Checklists can be based on experience of past failures and successes, but more formally, risk typologies and taxonomies can be developed to categorize or classify risks based on common attributes.[67]

Using risk typologies is very common in risk identification. An example of a risk typology that can be used by economic operators contains the following types of risks:[68]

Figure 12 Risk classification



Source: UNECE (2012).

Table 5 Assigning a risk category

Examples of risks	Risk category
'Possible loss of or damage to goods in transit'	Risks of processes related to the quality of product
'Supplier problems, including failure to supply'	Suppliers' risk
'Transport delays and potential hold-ups at ports'	Risks of processes related to the quality of product

Table 6 Examples of risks for each category

Risk category	Examples of risks
Business risk	'Big international importer entering the local market'
Currency risk	'Local currency will devaluate and imported products will become very expensive'
Legal risk	'Regulator will introduce new requirements on imported products'
Human resources	'Logistics expert will resign'
Occupational health and safety	'Accident at the port'
Operational risks	'Imported products of bad quality' 'Imported products do not comply with regulations'
Infrastructure risks	'A truck will break'

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Generalizing the risks of economic operators

Economic operators and their products are the main source of risks for which a regulatory authority is responsible. One way to identify risks on a regulatory system level is to generalize the risks of a single economic operator.

Table 7 Identifying regulatory risk based on risks of an economic operator

Risk of an economic operator	Risk of a regulatory system
'Imported products do not comply with regulations'	'Use of poor-quality products in production processes' 'Use of dangerous products in production processes'
'Supplier problems, including failure to supply'	'Shortage of the imported products on the market'
'Transport delays and potential hold-ups at ports'	'Disruption in the supply chain of critical businesses'
'Possible loss of or damage to goods in transit'	'Bankruptcies of importers'
'A truck will break'	'Transport infrastructure is not available in the sector'
'Accident at the port'	'Injuries at work'

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Even risks that seem to be internal to an economic operator, affecting its efficiency or profitability, can have undesirable external effects. When externalities are important, policymakers should give due consideration to risks.[69]

Identifying risks using categories of impact on SDGs

Risk classification that is based on the categorization of impacts of risk that can occur in a regulatory system also helps identify risk. The following classification describes risks that a regulatory authority should consider to determine whether they require regulatory intervention:[70]

Table 8 Economic operators' risks and the potential regulatory impact

Type of risk	Example of a food safety regulatory system
Risks that originate within an economic operator, the consequences of which may affect: ■ Consumers ■ Other businesses ■ The environment ■ Society in general	'Importers will expose consumers to long-term, not acute impact from pesticides' 'Consumers will be exposed to contaminated food' 'Poor hygiene at food producers and contamination'
Risks that originate with a single economic operator and whose mitigation requires coordination among economic operators because a single operator will not be able to mitigate on its own.	'Systemic shortage of essential products'
Risks that cannot be left for control of an economic operator.	'Food importers agree to raise prices simultaneously'

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Identifying risks across regulatory objectives and SDGs

Regulatory objectives and SDGs provide for another important input that must be considered to ensure the comprehensiveness of risk identification. The following table shows one approach to identify risks relevant to the Sustainable Development Goals, using three SDGs and three regulatory systems as an example.

Risks are identified against each objective of a regulatory system that supports the achievement of the respective SDG.

Table 9 SDGs and regulatory objectives as sources to identify risk

SDG	Objective of regulatory systems	Risk events (examples)
End poverty in all its forms everywhere	Food safety: ensure the availability of food for poor and vulnerable.	Higher food prices. Shortage of essential food products.
	Transport: ensure availability of transport for the poor and the vulnerable.	Increase in oil prices.
	Agriculture: increase resilience to shocks (climate and economic).	Delays in carrying out projects essential to increase resilience.
End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Food safety: increase trade in food.	Devaluation of the local currency.
	Transport: Ensure efficient transport for food products.	Shortage of infrastructure in ports.
	Agriculture: support new farms and economic operators in agriculture.	Lack of experts.

SDG	Objective of regulatory systems	Risk events (examples)
Ensure healthy lives and promote well-being for all at all ages	Food safety: ensure safety of food (including imported food)	Pesticides in plant products will cause non-acute poisoning. Contaminated milk products will cause acute poisoning.
	Transport: Reduce emissions. Reduce mortality rates in accidents.	
	Agriculture: Reduce the use of pesticides.	

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Applying taxonomies of other regulatory authorities

Many of the taxonomies that regulatory authorities apply to identify risk are available online.[71] These taxonomies can be used to ensure consideration of as many future events as possible that are similar to events that have happened in the past.

Scenario analysis

Using techniques to develop models of how the future might be is called scenario analysis (ISO 31010). Scenario analysis can involve building an imaginary but credible scenario, then exploring the nature of risks in this scenario. It is vital to develop scenarios of a pandemic similar to the one caused by COVID-19 and its impacts on every regulatory system. More general changes that are commonly considered when performing scenario analysis include:

- changes in technology
- possible future decisions that may have different outcomes
- stakeholder needs and how they might change
- changes in the macro environment (regulatory, demographics, etc.)
- changes in the physical environment

Regulatory authorities can use various combinations of the approaches described above for comprehensive risk identification. No matter which approach is chosen, data-driven approaches in risk identification are key.

Stakeholder involvement

Proactive stakeholder involvement is central to identify risk. Economic operators can provide valuable information about risks that regulatory authorities may not see. Similarly, market surveillance authorities and conformity assessment bodies are exposed to non-compliance risks that regulators cannot see.

Inclusiveness is important in risk identification. The following stakeholders should be invited to help identify risk in a regulatory system:

- Regulated economic operators
- Standardization bodies and relevant technical committees
- Conformity assessment bodies
- Market surveillance authorities and enforcement bodies
- Consumer organizations
- Academia

Prioritizing risks to the SDGs

The main goal of the risk evaluation is determining which of the identified risks are the most significant in a regulatory system. Several tools can be used to analyse, assess and evaluate each identified risk so they can be compared to one another and with the risk criteria. This requires evaluation of the probability and consequences of each risk.

Evaluating an impact of a risk

Risks that occur in regulatory systems simultaneously affect several objectives, and the consequences of each risk should be evaluated against every regulatory objective. The consequences of a risk of possible loss or damage to goods, especially in the case of essential food products, can be assessed against the regulatory objectives of the food safety system, as in the example below:

Risk/Objectives	Ensure the availability of food for poor and vulnerable	Increase trade in food	Ensure safety of food	Business efficiency	Impact on SDGs
'Possible loss of or damage to goods in transit (essential products)'	Affordable food becomes unavailable to vulnerable groups	Decrease in trade	No immediate impact	Additional costs of $50,000	Moderate impact on SDGs

This example shows the impact of the risk on all regulatory objectives, and this can be compared with the respective scale (see risk criteria). In the example, the highest level of consequences that the risk can cause is moderate. One possible approach is to consider the level of consequences of a risk as the greatest impact that it can have on all objectives. Other approaches, such as applying different weights, can also be taken.

Evaluating probability of a risk

The criteria for assessing probability of risk events must be defined. As tools to evaluate probabilities differ depending on the availability of data, probability evaluation criteria should be formulated in terms of:

- Expert's judgement, for cases in which no data are available;
- The frequency of events, for cases when the only information available shows how often something occurred in the past, or when frequencies are the best estimators of probable risk events (for instance, pandemics);
- Statistical probabilities, when data on risk events and relevant risk factors are available.

Probability criteria can be presented in a likelihood/probability table. The figure below explains the logic behind such a table. It establishes:

- The number of levels according to which probabilities will be assigned (five groups are identified in the figure). Different numbers of levels can be used, depending on the context of risk assessment.
- A title for each probability level (according to the table below, the lowest probability that can be associated with an event is defined as 'remotely possible', while the highest is 'likely'). Probability levels can be named differently.
- An explicit definition of every likelihood level (e.g. 'likely' means an event is expected to happen within weeks, while the probability of an event that is theoretically possible but extremely unlikely will be referred to as 'remotely possible'):[72]

Figure 13 Establishing likelihood criteria: Likelihood/probability table

Rating	Descriptor	Descriptor meaning
5	Likely	Expected to occur within weeks
4		
3		
2		
1	Remotely possible	Theoretically possible but extremely unlikely

Source: International Electrotechnical Commission (IEC), 2019.

In a regulatory system, the approach described above can be applied to develop the following table:

Table 10 Establishing risk criteria: Example of a likelihood scale

	Frequencies of similar events in the past	Statistical probability	Expert's judgement
High likelihood	Happened more than 10 times in the last year	>0.5	'Will definitely happen'
Moderate likelihood	Happened fewer than 10 times in the last year	0.1-0.5	'Everything that is not high and not low'
Low likelihood	Never happened before	<0.1	'Will not happen'

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

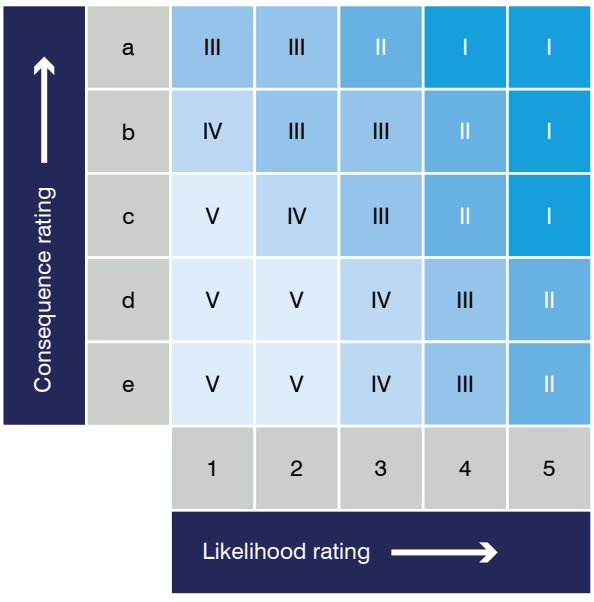
The probability of any risk can be evaluated against these criteria.

Evaluating the significance of risk

A consequence/likelihood matrix is a useful tool to evaluate and rank risk. To develop such a matrix, the scales of consequences and likelihood are combined to create risk categories based on both parameters.

In the matrix below, a risk category – as determined simultaneously by levels of consequences and likelihood – is represented by a Roman numeral (I being the most severe risk and V being the least). Darker colors signify higher levels of severity of a 'consequence-likelihood' combination.

Figure 14 Example of a consequence/likelihood matrix



Source: IEC (2019).

To evaluate the significance of risks, a list of identified risks (with their estimates of consequences and probabilities/ likelihood) should be combined with risk criteria, as in the table below for the food safety system:

Table 11 Combining consequences and likelihood scales

Consequences /Probability	Never happened before or statistical probability <0.1 or experts say 'will never happen'	Happened fewer than 10 times last year or statistical probability >0.1 but <0.5	Happened more than 10 times last year or statistical probability >0.5 or experts say 'will definitely happen'
Food is/becomes unavailable to large populations of poor and vulnerable or trade falls more than 50% or death or group poisoning or SDG not achieved		'Pesticides in plant products will cause non-acute poisoning'	'Systemic shortage of essential products.'
Food is/becomes unavailable to fewer than half of the poor and vulnerable groups or trade falls below 50% or poisoning involving more than 20 people or heavy impact on at least one SDG	'Consumers will be exposed to contaminated food.' 'Food importers agree to raise prices simultaneously.'	'Increase in food prices.'	
Several cases, when food is unavailable to poor and vulnerable, trade does not grow, poisoning involving fewer than 20 consumers, no impact on SDGs	III (Tolerable risks)	III (Tolerable risks) 'Devaluation of the local currency'	

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Consumers' subjective perceptions of risk can heavily influence evaluation of a risk in a regulatory system and result in a biased evaluation of a risk.

Current scientific knowledge should underpin risk management and assessment activities including key indicators through formalized and independent advisory processes. Such an approach ensures that the risks stakeholders and regulators perceive are examined against scientific and technical evidence, providing transparency while fostering support from stakeholders. This will enhance the science-informing policy and policy-informing science paradigms and approaches.

Regulatory frameworks: response to risk

Regulatory authorities can use any of the strategies described earlier in this publication to treat identified risks. When choosing a strategy, however, they must not look at risk in isolation from decision-making bodies. This means not focusing on smaller risks that are easier to tackle, but instead addressing the big risks that threaten several Sustainable Development Goal outcomes.

The table below shows how risk treatment strategies can be interpreted, as they can be applied within regulatory systems (using the risk 'pesticides in plant products will cause non-acute poisoning' in a food safety regulatory framework):

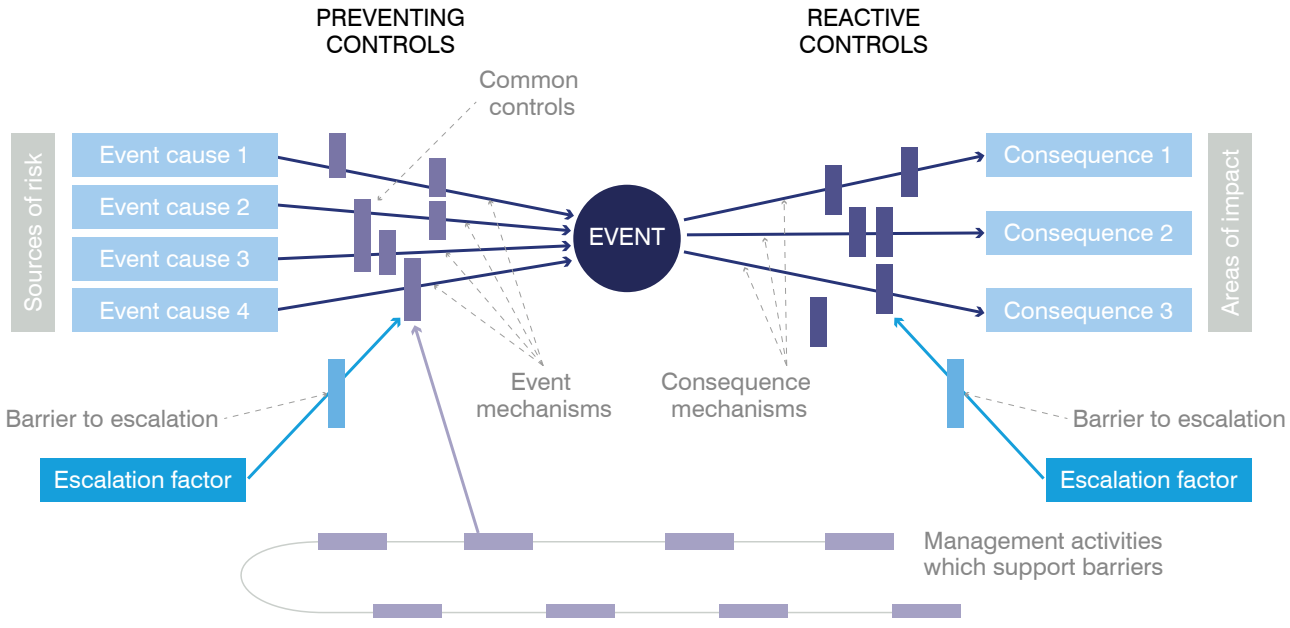
Table 12 How can risk treatment strategies be interpreted?

Risk treatment strategy	Interpretation of the strategy on a regulatory system level	Example
Risk avoidance	Banning activities or processes where the risk can occur.	Banning the import of fruits and vegetables. Banning the use of pesticides in local production.
Sharing the responsibility for managing the risk	Sharing the responsibility for managing the risk, including bearing responsibility if it occurs, with economic or social actors.	Making economic operators responsible for the risk.
Mitigating the risk	Developing a regulatory or non-regulatory response to reduce the probability and the expected impact of a risk. A regulatory authority should address risks that exceed the tolerable level.	Imposing a regulation that controls the level of pesticides in products.
Tolerating a risk	In a regulatory context, tolerating a risk means the regulators decide they are unwilling or unable to take steps to reduce the probability and expected impact of a risk.	Preparing a plan in case the risk occurs.

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Choosing a risk mitigation strategy that is proportionate to the risk being addressed can be challenging for regulatory authorities, as it requires systematizing big amounts of information from different sources. Bow tie analysis is an efficient tool that regulatory authorities can use when choosing proportionate risk mitigation strategies. It allows for graphical representation of possible causes and consequences of a risk and helps the authorities analyse ways to modify the likelihood and the impact of a risk.

Figure 15 Example of the bow tie method



Source: IEC (2019).

To illustrate the method, we assume that a regulatory authority responsible for public health is tasked with developing a proportionate response to 'pesticides in plant products'. The following steps are required to apply a bow tie analysis technique:

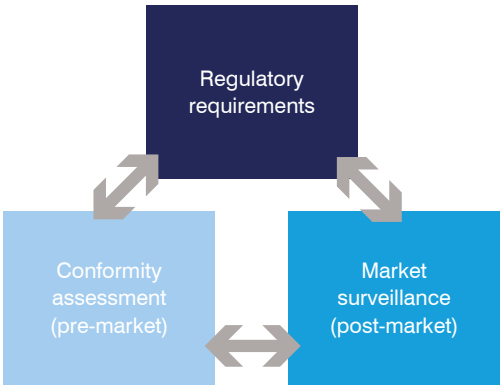
- Representing the risk event by the central knot of the bow tie: 'pesticides in plant products';
- Listing the sources of risk on the left-hand side of the knot and joining them to the knot by lines representing the different mechanisms by which sources of risk can lead to the event:
  - Improper use of pesticides in local agriculture
  - High level of pesticides in imported products
- Drawing on the right-hand side of the knot lines to radiate out from the event to each potential consequence:
  - Vulnerable groups will directly consume products with pesticides
  - Products with pesticides will be used in used in food production processes
  - Acute poisoning
- Designing **preventative controls** that can minimize the impact of (or remove) each risk source, and depicting them as vertical bars across the lines. Examples include:
  - Regulatory requirements on the maximum level of pesticides in products
  - Regulatory requirements on the use of pesticides in production
  - Certification of local food producers
  - Inspecting imported products
  - Inspecting local producers
  - Running information campaigns aimed at preventing consumption of unwashed products
- Designing **reactive controls or barriers**, which can modify the consequences of the risk event should it occur, and drawing vertical bars to represent each of them after the event:
  - Planning recall programmes
  - Removing non-compliant products from the market
  - Conducting information campaigns

Regulation as a risk mitigation tool

The essential building blocks

Regulation, which is one of the available risk mitigation tools, can be presented as a set of three interdependent building blocks:

Figure 16 Building blocks of a regulation



Source: Valentin Nikonov, 2020. Presentation made at the annual session of the UNECE Working Party on Regulatory Cooperation and Standardization Policies. Available at https://unece.org/info/Trade/WP6-Meetings/events/17809.

The objective of the first element of a regulatory framework – regulatory requirements – is to ensure that dangerous products are not placed on the market (the term 'dangerous' is, of course, relative; in this context, a dangerous product is one whose risk level is higher than the accepted risk level).

The objective of the second element of a regulatory system – conformity assessment processes – is to ensure that non-compliant products are not placed on the market. The European Union's Blue Guide on the implementation of EU product rules defines conformity assessment, as a form of pre-market control, as the 'process carried out by the manufacturer in demonstrating whether specified requirements relating to a product have been fulfilled'.[73]

Finally, market surveillance, as a form of post-market control, aims at removing non-compliant goods from the market, in case they were produced despite regulatory requirements and were not prevented from being placed on the market by conformity assessment.

If achieving an SDG requires regulatory intervention, regulations, standards and guidelines should be developed from the premise that 'people want to comply'. The mechanisms of implementation and awareness raising must be efficiently integrated in the operations of a given sector to be effective at reaching a certain objective, including through the adoption of guidelines.

The following actions must be carried out to apply a regulation as a risk mitigation tool.

Making regulatory requirements proportionate to risks

This step includes developing the text of a regulation, conducting the regulatory impact assessment and implementing a regulation.

The TBT agreement defines technical regulation as a

> *'document which lays down product characteristics or their related proceses and production methods, including applicable administrative provisions, with which compliance is mandatory [...] which may include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method'.*

The 'product characteristics or their related processes and production methods' that seek to make an item safer generally aim at removing sources of risks associated with products (any risk can be mitigated by removing risk factors). Although risk factors change from product to product, common examples include poor production processes, use of dangerous materials and use of the product by children.

A technical regulation that establishes the required quality of the product production process, or forbids the use of dangerous materials, among others, reduces the risk level of a product, provided it complies with the requirements. At the same time, no technical regulation will make a product absolutely safe; a certain amount of risk, which must not exceed the level that a regulatory authority is willing to tolerate, will still be associated with the compliant product.

In case of the risk of pesticides in the previous example, these rules may contain:

- The allowed maximum amount of pesticides and chemicals in products
- Requirements for procedures for internal control of economic operators
- Requirements for personnel working with pesticides

As soon as regulatory requirements are established, a product becomes a regulated product that may be compliant or non-compliant. A compliant product has a risk level that is tolerated by a regulator. Products that meet regulatory requirements are not risk-free; rather, they are not more dangerous than the level of risk that is tolerated by the regulator.

Defining the tolerable level of risk associated with a product, or the level of risk of a compliant product, is one of the most challenging tasks of a regulatory authority, especially in the case of new products.

Conformity assessments and market surveillance are the main processes designed to mitigate the risk of non-compliance in any regulatory framework.

Choosing conformity assessment procedures

Building conformity assessment processes (pre-market control) is essential to ensure that goods and services meet the requirements specified in the regulation. Conformity assessment procedures can be implemented in different ways – from self-declaration of conformity to obligatory third-party certification. As conformity assessment is a form of pre-market control, a product cannot be placed on the market unless these procedures are properly implemented.

In the ideal world, when conformity assessment procedures are in place, only goods that meet regulatory requirements are placed on the market. In many economic sectors, this is not the case. Market surveillance activities complement procedures for pre-market control.

Choosing market surveillance activities

Conformity assessment procedures seek to prevent non-compliant products from being placed on the market. Market surveillance procedures, including import compliance, in turn, aim at blocking the impact of the non-compliance risks by removing non-compliant products from the market.

Competent authorities perform market surveillance activities, such as inspections of imports and of products within the local supply chain. Production processes also fall within the scope of market surveillance. Enforcement is a necessary

component of any regulatory system, and sufficient resources should be allocated to its planning and its execution.

Local market surveillance authorities and enforcement bodies play a vital role in achieving regulatory objectives and the SDGs, because they are responsible for enforcing all regulations, regardless of which authority set them and at which level they were set (including international regulations).

UNECE's Recommendation T 'Standards and Regulations for Sustainable Development',[74] states that if there are regulatory failures, including high levels of non-compliance, policymakers should analyse the entire regulatory system, including the need to enhance the market surveillance framework, rather than introduce new regulations.

Market surveillance challenges

OECD analyst Florentin Blanc[75] provides a comprehensive overview of the main challenges and problems of market surveillance. He highlights the imbalance between efforts to improve regulations for businesses and those seeking to improve the enforcement and delivery of these regulations. Indeed, several methodologies – including regulatory impact assessments, which are obligatory in many countries – aim to develop regulatory requirements and ensure their proportionality to risks. No common methodology on market surveillance has become as popular as these assessments.

In many countries, inspections are based on unclear requirements. This creates high costs for the state and burdens for business, 'providing disappointing outcomes in terms of securing public goods', according to Blanc. One of the main reasons for such inefficiency is an inadequate focus on risk, leading to a situation in which 'many businesses get inspected, even though their risk level is low or moderate'. Other causes include overlaps in the activities of different inspecting agencies and a focus on finding violations rather than improving compliance and outcomes.

Critical issues to improve the inspection and enforcement systems include clarifying which agency should deal with which type of risk and ensuring risk focus in resource allocation, planning and implementation of market surveillance.

Even a compliant product can be dangerous

The interrelation among three parameters – stringency of regulatory requirements, level of risk of a compliant product and level of risk of a non-compliant product – is crucial for setting priorities in post-market control.

Figure 17 Regulatory requirements, risk of compliant and non-compliant goods

Source: Valentin Nikonov (2016). Presentation made at the annual session of the Working Party on Regulatory Cooperation and Standardization Policies. Available at https://unece.org/fileadmin/DAM/trade/wp6/documents/2016/PPTs/VNikonov_Rec_S.pdf..

A non-regulated product cannot be non-compliant, so it carries no non-compliance risk. When regulatory requirements are applied and are low (or less stringent), the risk of a compliant product becomes smaller than the risk of a non-compliant product. More stringent requirements increase the difference between the risk of a compliant and a non-compliant goods (the terms 'low' and 'high' or 'more or less stringent' are relative terms in this context).

Goods with the biggest difference between the risks in the compliant and in the non-compliant states should be given the highest priority by market surveillance authorities and border agencies.

Non-compliant products can also be more or less dangerous. The damage that can be caused by different non-compliant goods will vary depending on many factors, such as safety expectations related to the product and its way of use.

Figure 18 Categorizing goods in terms of 'dangerous-compliant'

Source: Valentin Nikonov (2016). Presentation made at the annual session of the Working Party on Regulatory Cooperation and Standardization Policies. Available at https://unece.org/fileadmin/DAM/trade/wp6/documents/2016/PPTs/VNikonov_Rec_S.pdf.

Conformity assessment and market surveillance deal with the risk 'non-compliant product placed on the market'. Their main objective is to minimize the non-compliance risk associated with the product. Hence, a high-risk product for a market surveillance authority is not one that is perceived as dangerous (but meets regulatory requirements), but one that is non-compliant and is dangerous when non-compliant.

Setting right priorities in enforcement requires management of non-compliance risks, which can be expressed in terms of consequences and probability of non-compliance. For market surveillance and import compliance procedures to be proportionate and to complement the other two parts of a regulatory framework effectively, they should focus on high-risk products (shipments) – those that are dangerous when non-compliant and have a high probability of non-compliance.

Import compliance is important for post-market control

Import compliance procedures are an important block in any market surveillance system, as 'points of entry [are] the place where all products from third countries have to pass by [and they are] the ideal place to stop non-compliant products before they are released for free circulation'.[76]

Inspecting products that are placed on the market is the main work of product regulators and market surveillance authorities. As it is not possible or desirable to inspect all goods, and given the limited resources of market surveillance authorities, one of the main challenges regulatory authorities face is prioritizing market surveillance activities: which products and when to carry out an inspection, and how to check them.

Addressing this challenge requires developing risk-based market surveillance systems that allow:

- Targeting non-compliant products on the market and prioritizing market surveillance activities based on the evaluation of non-compliance risk posed by each product;
- Devising sampling plans that are proportionate to the level of non-compliance risk;
- Choosing adequate sanctions if non-compliance is identified;
- Promoting the culture of compliance.

Building such a system requires ranking products against the following parameters:

- Consequences of non-compliance, so goods that are more dangerous when non-compliant (having more severe consequences of non-compliance) are given a higher priority than other goods.
- Probability of non-compliance, so products that have a higher probability to be found non-compliant on the market are given higher priority than other products.

Market surveillance frameworks should be based on evaluation of the non-compliance risk of a product in contrast to the inherent risk of a regulated product (risk of a compliant product).

Import compliance procedures and border inspections are essential for efficient market surveillance. Market surveillance authorities are responsible for both locally produced and imported products. Locally produced goods can only be inspected when sampled where they are sold, while imports can be inspected both at the ports of import and at the later stages of marketing. It is more efficient to inspect imported products at ports of entrance, because such inspections:

- Minimize consumer exposure to non-compliant products;
- Allow more representative sampling, as products are concentrated;
- Are less costly – products arrive to an inspector and not inspector arrives to products;
- If non-compliance is identified, it is easier to remove products from the market;
- Products can be simultaneously inspected for various non-compliant risks;
- Products are in any case subject to customs controls.

Import inspections can be compared to a water filter for a pool. It is more efficient to filter water as it enters the pool than to remove substances from the water once the pool is full. Import compliance frameworks are therefore important tools for regulatory authorities to minimize the risk of non-compliance associated with traded products.

Guidelines to build import compliance procedures that are based on the principles described above are presented in the following chapters.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Chapter 4

How to build a risk-based targeting system

How to build a risk-based targeting system

A risk-based targeting system is the central element of any import compliance framework. A border control agency inspecting imports targets incoming shipments according to their levels of non-compliance risk, using formal tools or on the basis of inspectors' intuition. Even the extreme cases of import compliance strategies, i.e. regulatory regimes in which every incoming shipment is inspected, are based on risk targeting. The same is true when every shipment is released without an inspection.

In the first scenario, all shipments are targeted as high-risk, while in the second, all are targeted as low-risk. Random inspections, a strategy widely used in border control, are also a form of risk-based targeting. In this case, high-risk shipments are selected by 'tossing a coin', with the only difference that generators of random numbers are used instead of a coin.

Successful risk-based targeting allows the regulatory authority to guess correctly about the actual status of incoming shipments before or upon their arrival. This enables the authority to 'concentrate on high-risk shipments and expedite the release of low-risk shipments', as the TFA notes.

If not done well, however, targeting may cause situations where compliant shipments are inspected (and found to be compliant) and non-compliant shipments are released without an inspection, generating various types of losses (depending on what kind of non-compliance risk the targeting system is addressing).

Any import compliance targeting system is risk-based, i.e. it evaluates the level of uncertainty associated with each incoming shipment – if it complies or not – and the impact that the given case of non-compliance would have on regulatory objectives. As in all cases of risk management, targeting can be more and less efficient.

This chapter outlines a methodology to build an efficient risk-based targeting system that all regulatory authorities involved in border control can use. It presents a holistic reference model of an import compliance targeting system that can be used to create new and evaluate existing risk-based targeting frameworks. The chapter also discusses the main processes of a targeting system and their inputs, using a case study to show how these processes can be implemented in practice.

Approaches described in the chapter apply to all kinds of products in all countries. When showing examples of datasets that should support risk-based decisions, we will often use capital letters (A, B, C, etc.) to indicate the names of products, countries and ports, as well as other shipment characteristics.

Targeting high-risk shipments requires assessing the level of non-compliance risk of each incoming shipment (and, often, comparing it with that of other shipments). Special attention is given to tools that allow comprehensive identification of non-compliance risks.

Building blocks

The following 'toy' case study (which reflects real situations at the border) will be used for illustration purposes in this chapter. Ten shipments containing toys – scooters, pedal cars and dolls – have just arrived at the border and must be processed by the responsible regulatory authority. For the purposes of the case study, the figure below provides basic information about the shipments and their compliance statuses (shipments in red are non-compliant, shipments in green contain complaint products).

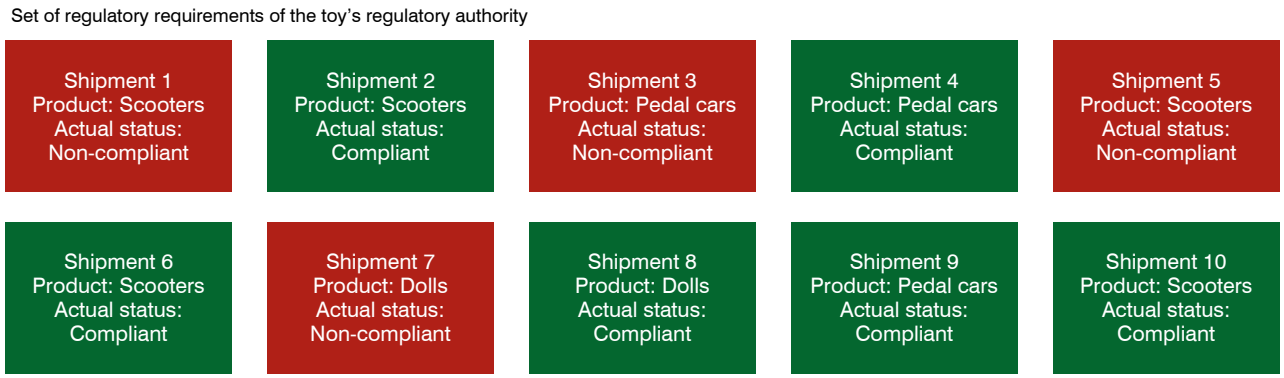
An authority responsible for toy safety will be used as an example, though approaches described in this chapter can be applied to any set of regulatory requirements. Moreover, while arriving shipments are subject to many other regulatory requirements, we will limit the description to only one set of requirements for the purposes of this chapter.

Uniform inspection examples

All shipments targeted as high-risk

To describe the main parameters of a risk-based targeting system and import compliance in general, we first consider the two extreme scenarios of import compliance. In the first scenario, every shipment is targeted as high-risk and is inspected.

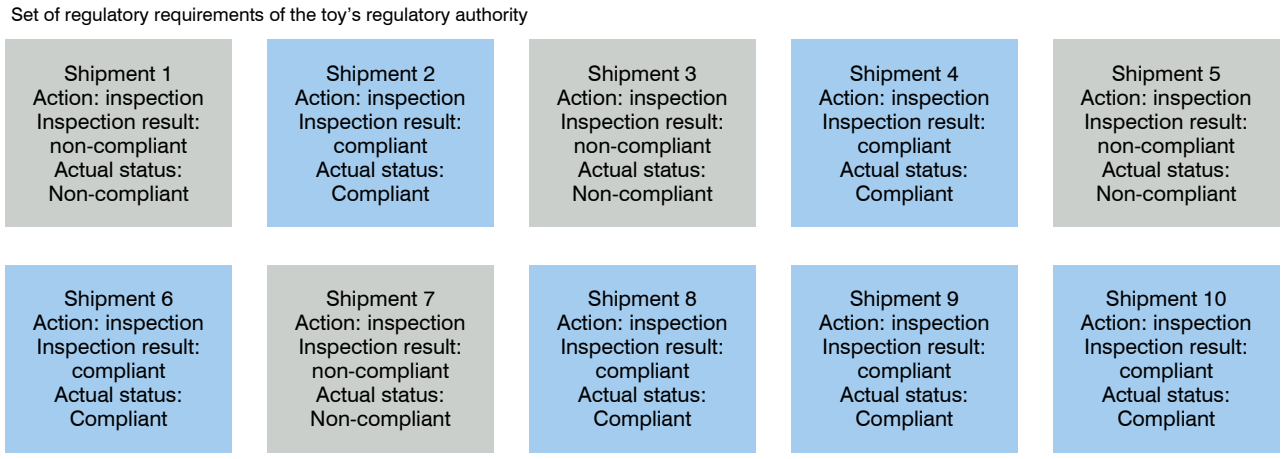
Figure 19 Case study: All incoming shipments targeted as high-risk



Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

To determine the actual compliance status of the arrived shipments, a regulatory authority must carry out 10 inspections that require allocating 10 inspection units. To simplify the example, we will use 'inspection units' (similar to man-hours) as a parameter characterizing the resources needed to perform an inspection, in terms of time – its duration, time for the follow-up and human resources.

Figure 20 Performance of a system when every shipment is targeted as high-risk



Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

Inspection units allocated per shipment determine the **border compliance time** for an importer. Even if one man-hour is required to inspect a shipment, and an inspector assigned, border compliance will take more than an hour, because of waiting time and the time required for follow-up after the inspection. For the purpose of the case study, we will assume that inspections are consequently performed by one inspector only and will consider border compliance time 150% of an inspection duration.

The **inspection rate** in this case is 100% (all shipments are evaluated). In the example, four shipments are found to be non-compliant. This means a 40% **non-compliance (or interception) rate**, one of the main parameters of a targeting system. The regulatory authority can reduce the non-compliance rate by promoting compliance and working with the importers. At the same time, a targeting system cannot change the non-compliance rate and this parameter does not characterize the efficiency of a targeting system.

The results of the uniform regulatory regime in which every shipment is considered to be high-risk are shown in the figure above. The targeting system correctly evaluated only four shipments as non-compliant. The other six shipments were compliant, even though they were targeted as high-risk and inspected.

The assumption in this example is that results of inspections correspond to the actual status of the incoming shipment. In reality, however, one has to consider the possibility of errors in the inspections. Every inspection involves sampling, and its efficiency depends on the available resources, its duration and equipment quality.

Inspection efficiency should also be considered when building a targeting system. The number of non-compliant shipments that were inspected and considered compliant as well as the number of compliant shipments that were inspected and considered non-compliant are two important parameters of the import compliance system.

Every shipment is targeted as low-risk

To illustrate other important characteristics of a targeting system, a scenario in which every shipment is targeted as a low-risk shipment can be considered. This regulatory regime, in which there would be no inspections, results in the following scenario:

Figure 21 Performance of a system when every shipment is targeted as low-risk

Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

Two important parameters that this scenario represents are the number of non-compliant shipments released without an inspection and the number of compliant shipments whose release was expedited. Four dark purple boxes represent targeting errors that led to losses due to non-compliance (losses can differ, depending on the nature of regulatory requirements) and six light-purple boxes represent the correct functioning of the system.

Most of the parameters that characterize a targeting system represent different combinations of shipment assessment, performed by the targeting system and actual status of the evaluated shipment, and – if the shipment was targeted as high-risk and inspected – result of the inspection (whether it corresponds to the actual status of the shipment).

Figure 22 Main parameters of a targeting system

Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

Table 13 Parameters of a targeting system (based on case study)

Parameter, characterizing a targeting system	Comments	The system targets every shipment as high-risk	The system targets every shipment as low-risk
Number of incoming shipments	Total number of shipments within a given period.	10	10
Non-compliance rate	Percentage of non-compliant shipments.	40%	40%
Inspection rate	Percentage of the incoming shipments inspected.	100%	0%
Inspection units	Resources of regulatory authority invested in inspections (man-hours).	10	0
Number of inspected non-compliant shipments (targeted as high-risk)	Number of shipments that the system correctly identified as non-compliant. Represents losses prevented by the targeting system.	4	0
Number of inspected compliant shipments (targeted as high-risk)	Shipments that the system identified as non-compliant but that were found to be compliant during an inspection. Represents resources that could have been invested in high-risk shipments.	6	0

Parameter, characterizing a targeting system	Comments	The system targets every shipment as high-risk	The system targets every shipment as low-risk
Number of released non-compliant shipments (targeted as low-risk)	Non-compliant shipments that were targeted as low-risk and released without inspection (the actual number of such shipments is often unknown). Represents losses linked to consequences of non-compliance.	0	4
Number of released compliant shipments (targeted as low-risk)	Number of compliant shipments that were correctly classified as low-risk by the system and release without inspection.	0	6
Border compliance time	Time that a shipment is held at the border awaiting an inspection, during the inspection and the follow-up. Can be represented as a function of the duration of an inspection, (as stated above, we assume that border compliance time is 150% of an inspection duration).	15 hours (under the assumption that shipments are inspected by one inspector)	0

Source: Valentin Nikonov, table prepared to illustrate the methodologies described in the guide.

These parameters can be represented as a percentage of the total number of shipments. Parameters that represent inspection errors – i.e. compliant shipments that were inspected and considered non-compliant and vice versa – will be introduced later in this chapter.

Objectives

The two import compliance systems discussed above can be considered as risk-based. In both cases, however, the assessment of the non-compliance risks is often inaccurate and leads to two types of regulatory errors.

In the first scenario, when all shipments are inspected, the regulatory authority's resources are allocated inefficiently. Every inspection of a compliant shipment represents an opportunity cost, because the resources invested in this shipment could be shifted to high-risk shipments. When there are enough resources to inspect all 10 shipments that arrived, even if it would not reduce the overall border compliance time for importers, it still would be more efficient to switch resources from low-risk to high-risk shipments. Allocating more resources per inspection ensures higher efficiency and reduces the number of errors.

The second scenario, although characterized by zero border compliance time for importers and no resources required to perform inspections, leads to losses associated with non-compliance of shipments and imported products. Four non-compliant shipments would not be stopped as a result of an inspection at the border. Losses associated with non-compliance can be different, depending on the type of non-compliance risk under the responsibility of a regulatory authority. In the case of toys, non-compliance can lead to loss of life.

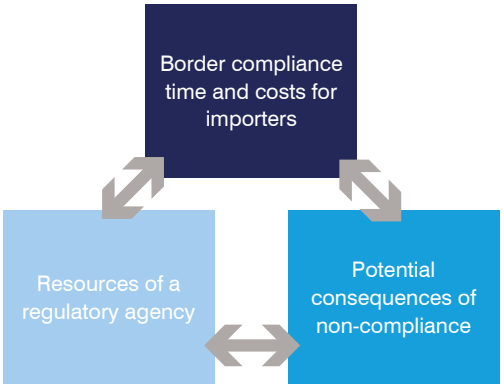
In neither scenario an optimal balance among the key parameters characterizing an import compliance framework is achieved. Minimizing inspection units and border compliance time – i.e. performing fewer inspections – indeed expedites the release of shipments, but the benefits of faster released shipments do not justify the impact that the released non-compliant products will have on consumers. In the first scenario, the losses associated with the potential consequences of non-compliance can be minimized more efficiently in terms of the regulator's resource allocation and from the trade facilitation perspective.

The ideal system would target the four non-compliant shipments as high-risk, allocate four inspection units to prevent the spread of non-compliant products on the market and release the other six compliant shipments without inspection. Depending on the available resources, this scenario would lead to six hours of border compliance time (this parameter can be reduced if more resources are allocated to perform each inspection). The ideal targeting system is not achievable, however, because – as like any risk management system – it cannot aim at zero risk; uncertainty will always remain and no system can eliminate it.

Like any risk management application, the targeting system generally aims to allow regulatory authorities to find the right balance among the three parameters (within a given period):[77]

- Anticipated payoff: In a regulatory context, this parameter represents the achievement of regulatory objectives. In the case of import compliance, it can be expressed by border compliance time for importers, as a symbol of free undisrupted trade;
- Potential losses: These include losses associated with the consequences of non-compliance and can be measured by the number of non-compliant shipments that were released without an inspection (targeted as low-risk) or considered compliant as a result of an inspection;
- Costs of safety: These are represented by inspection units allocated to perform inspections.

Figure 23 The three main parameters are interdependent



Source: Valentin Nikonov (2018), presentation at the UNECE Group of Experts on Risk Management in Regulatory Systems webinar.

For any non-compliance rate (parameter that a targeting system cannot change):

- Decisions to minimize the compliance time and costs will require more resources to carry out the inspections (number of inspection units) or will increase the consequences of non-compliance (more non-compliant shipments will be released).
- If a regulatory authority wants to lower the number of inspection units allocated to perform border control, the potential losses associated with the non-compliance risks or time of border compliance will increase.
- Minimizing the potential consequences of non-compliance risks means more resources will be needed to perform border inspections or will increase compliance times and costs for importers.

The interdependency of the three parameters can be expressed in the following way:

For a given level of risk management implementation,

- Minimizing the number of non-compliant shipments released without inspection will mean more inspections, and this will lead to an increase in the number of compliant shipments that are inspected;
- Minimizing the number of compliant shipments inspected will require a decrease in the total number of inspections and will increase the consequences of non-compliance;
- Border compliance time can be lower by increasing the number of inspection units available, for a given level of non-compliance risk (represented as a number of non-compliant shipments released without inspection).

Balancing risk tolerance with available resources

A risk-based targeting system can be viewed in the context of other decision-making frameworks, in which decisions address uncertain situations. Courtroom verdicts made by judges or medical diagnosis systems are examples of such frameworks. No matter how different the scope of the application of these systems may be, they are based on the same statistical concepts of hypothesis testing.

When a shipment arrives at the port or when a defendant enters the courtroom, the truth is unknown. In the first case, the default or null hypothesis is that a defendant is innocent. This same approach can be applied in import compliance – that a shipment complies with regulations.

In both cases, evidence – facts that are considered to be known and true – is gathered to be used to evaluate whether the hypothesis should be accepted or rejected. In case of import compliance, evidence is everything that is known about the shipment when it arrives: the importer, the product, the route of the ship, etc.

In all systems that are based on the hypothesis-testing principle, two types of errors are possible after the available evidence about an uncertain situation has been analysed. Cases where a judge convicts an innocent defendant,

an import compliance system inspects a compliant shipment or a medical diagnostic system finds that a healthy person is sick are examples of type I error. The magnitude of the type I error in a regulatory environment can be measured by the number of compliant shipments that were deemed high-risk and inspected.

A type II error is a situation in which a judge acquits a criminal, an import compliance system releases a non-compliant shipment without inspection or a medical diagnostic system finds that a sick person is healthy.

These two error types are embedded in risk-based systems and should be considered when devising a targeting framework. In the import compliance context, both type I and type II errors can be seen as regulatory errors. A type II error manifests itself in terms of losses associated with the consequences of non-compliance. One way to reduce type II errors is to carry out more inspections, which would require more resources of the regulatory authority and would lead to more type I errors (more inspections of compliant shipments).

The level of non-compliance risk that a regulator will accept (risk tolerance) can be represented by the type II error and expressed in terms of a tolerable number of non-compliant shipments that will be released. The import compliance system seeks to bring the risk level to the tolerable level with minimum resources.

Risk tolerance is a fundamental input into an import compliance framework. It should be proportionate to the available resources and be explicitly defined. Depending on parameters, such as the compliance rate, it is possible that the tolerable level of risk cannot be achieved with the available resources. In this situation, either risk tolerance or resources should be increased.

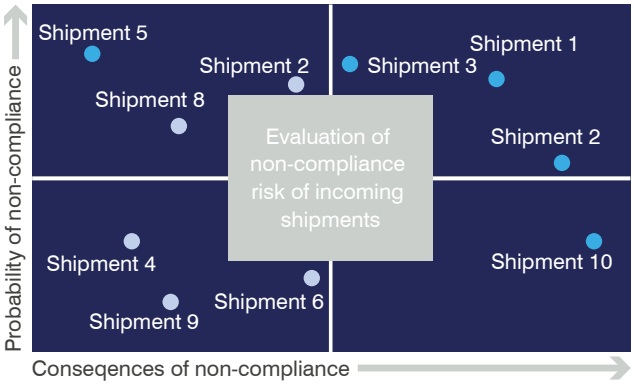
Setting priorities by evaluating non-compliance risk

Targeting systems assess the non-compliance risk of incoming shipments by comparing the characteristics of each shipment with the risk profiles or compliance rules, based on probability factors and the consequences of non-compliance. This allows the regulatory authority to rank incoming shipments according to the level of non-compliance risk and concentrate on those that are high-risk, meaning they:

a. Have high consequences of non-compliance (e.g. products in these shipments are dangerous when non-compliant);

b. Have a high probability of non-compliance.

Figure 24 Example of the results of risk-based targeting



Note: Blue dots represent shipments that can be considered high-risk. All other shipments have either a lower probability of non-compliance for a similar level of harm, or a lower level of harm for the same probability of non-compliance.

Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

One principle of risk management is that zero risk is not a viable regulatory objective. Indeed, no regulatory authority can inspect all shipments. The figure above is useful to set priorities of regulatory interventions: it allows the comparison of shipments according to their levels of non-compliance risk, simultaneously taking into account the consequences and probability of non-compliance (the horizontal axis measures the consequences of non-compliance, while the vertical axis measures the probability of non-compliance).

A shipment can contain goods that are very dangerous when non-compliant, but the probability that products in the shipment are actually non-compliant can be extremely low. The opposite is also true: products in the shipment can have a very high probability of non-compliance, but the consequences of non-compliance can be very low.

Both of these cases are less important than a situation in which the products are both dangerous when non-complaint and have a high probability of being found non-compliant on the market. Non-compliance risk is therefore relative and can be evaluated in comparison to a certain benchmark, e.g. to the non-compliance risk of other products.

One way to illustrate the non-compliance risk of incoming shipments is to use a graph where all shipments subject to a certain set of regulatory requirements are represented (similar to the figure above) showing:

a. The severity of the consequences of non-compliance associated with each shipment;

b. The probability that each shipment is non-compliant or contains non-compliant products.

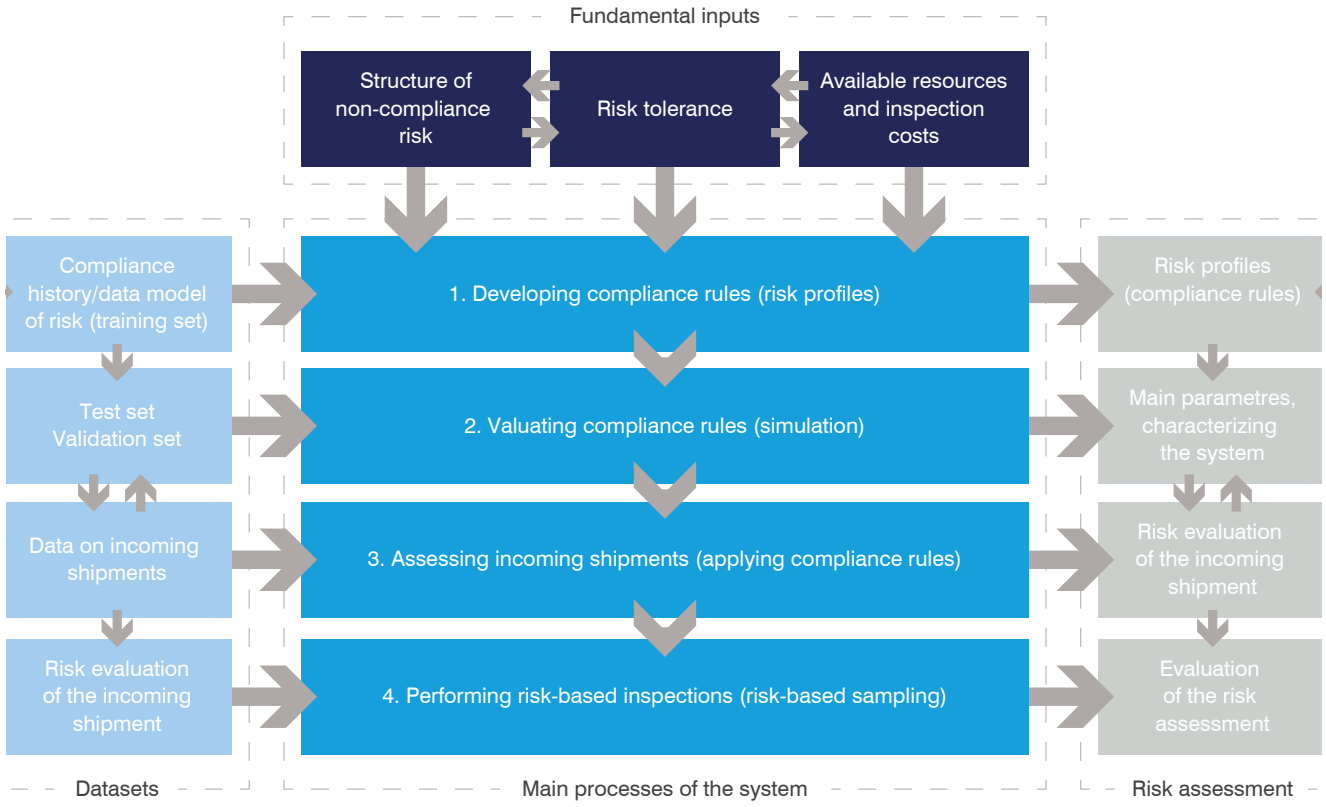
Such a graph allows shipments to be ranked according to non-compliance risk by applying the Pareto optimality principle[78] in terms of consequences of non-compliance and the probability of non-compliance. The Pareto optimality principle in this context has the following meaning: one can say that shipment A has a higher level of non-compliance risk than shipment B when:

- both consequences and probability of non-compliance of shipment A are higher than of shipment B;
- shipments A and B have the same consequences of non-compliance, but the probability of non-compliance of shipment A is higher than the probability of non-compliance of shipment B;
- shipments A and B have the same probability of non-compliance, but the consequences of non-compliance of shipment A are higher than the consequences of non-compliance of shipment B.

Reference model

The reference model described in the following pages is a prerequisite for developing a targeting system that would bring the non-compliance risk to the tolerable level and will be performing as close as possible to an ideal framework, i.e. with minimal required resources of regulatory authority.

Figure 25 Reference model of a risk-based targeting framework



Source: UNECE (2021). Recommendation V on 'Addressing product non-compliance risk in international trade'.

The reference model presents available resources, risk tolerance and a structure of a non-compliance risk under the responsibility of the regulatory agency as fundamental inputs into the system. The relationship between the available resources and risk tolerance have been already described. The structure of the non-compliance risk is important as it constitutes a basis to profile the risk of incoming shipments – assessment of the likelihood of non-compliance – and to evaluate the consequences of non-compliance.

As risk management is a process that inputs data, the model is structured around the three main elements of a targeting system: a flow of functions, a data flow required to support these functions and a resulting flow of risk evaluations.

The structure of non-compliance risk, especially the probability factors, forms the basis to build history datasets that are used to develop risk profiles or compliance rules. This building block of a targeting process can be implemented in many ways – from the simplest (using expert judgement or non-structured data) to the most sophisticated (using predictive algorithms, such as neural networks or random forests.)

The compliance rules and risk profiles should be evaluated and compared with the risk tolerance of a regulatory authority. To this end, a test and validation datasets should be developed and simulations performed. Results of the simulations – application of compliance rules to the history data, providing information on what would have happened if a regulatory authority had applied the compliance rules in the past – result in the same parameters that are used to define the risk tolerance.

If the compliance rules and risk profiles meet the regulator's risk tolerance requirement and can be implemented using the available resources, they become operational. Every incoming shipment is evaluated against the rules. As simple as it sounds, this operation requires data processing that provides the system with all the data needed to implement the rules.

The final step of the process is risk-based sampling – inspecting the shipment according to the risk evaluation or releasing it without an inspection. If an inspection is performed, it shows the accuracy of the targeting system's prediction. In any case, information on the inspections is added to the history dataset and used to update the compliance rules.

The model shows that a targeting system should be constantly updated. These updates can be categorized as fundamental and operational. The former include changes in the fundamental inputs of the system. Changes in the risk tolerance of a regulatory authority or the available resources may require an overhaul of the compliance rules, as the regulatory regime would need to meet the new requirements in terms of the number of non-compliant shipments, which release without an inspection can be tolerated by the system.

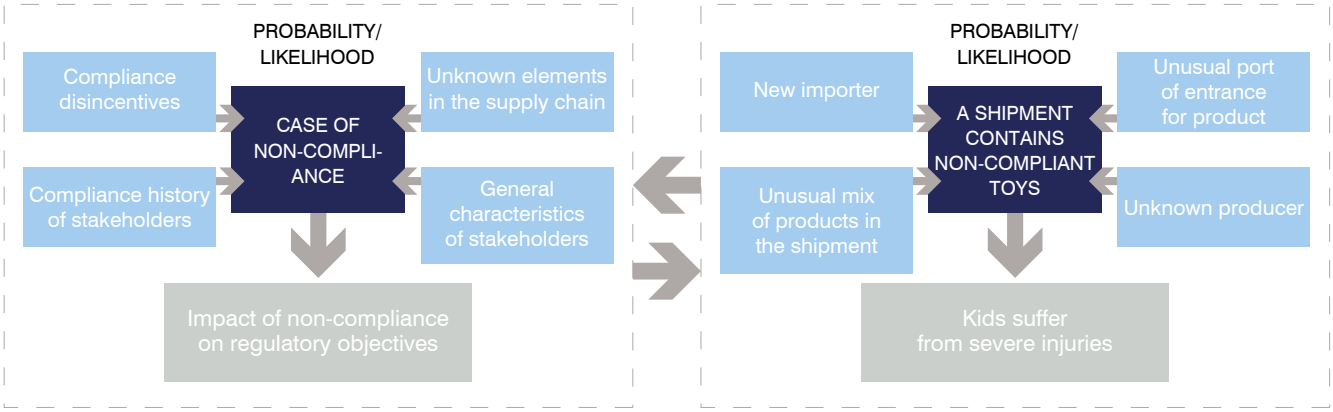
Changes in the structure of the compliance risk – appearance of new cases of non-compliance or changes in the probability factors – also require rebuilding of the targeting process. This is because such changes, at the very least, require building and processing new datasets. Fundamental changes should not happen often. In any case, the system should be reviewed with respect to the required fundamental changes systematically.

Operational updates of the system also occur, but on a more regular basis. These updates enable the targeting system to benefit from the principles of machine learning and include updating the history datasets with the results of inspections that were conducted since the last update. In most cases, bigger datasets provide for better risk profiles and compliance rules.

Structuring non-compliance risk

The figure below shows a general model of a non-compliance risk and how it can be applied in the context of the toys case study:

Figure 26 Understanding the structure of a non-compliance risk



Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

Any targeting system is based on the structure of the non-compliance risk within its scope. Correct and comprehensive identification of the non-compliance risk is crucial to set priorities of a regulatory authority in general and for correct targeting of the incoming shipment in particular.

According to the general model of a risk (see Chapter 2), full identification of a non-compliance risk requires knowing:

- The specific type (or types) of non-compliance that is (are) being targeted (a risk event);
- The impact that this type of non-compliance would have on the regulatory objectives (impact of a risk);
- Risk factors (often called probability factors or vulnerabilities), formulated in terms of known characteristics of an incoming shipment or a supply chain that determine the likelihood of the type of non-compliance being targeted;
- The likelihood or probability that a shipment has the specific type of non-compliance (identified as a risk event).

Identifying types of non-compliance for targeting

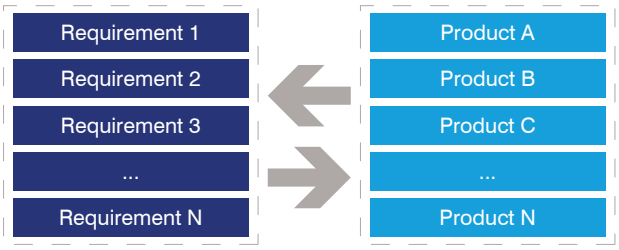
Even if a targeting system is limited to one set of regulatory requirements, like in the case study of shipments with toys, in which an assumption was made that only toy safety regulations are within the scope, formalizing types of non-compliance that should be included in a targeting system can be challenging.

Most regulations that are applied in border control contain multiple requirements on regulated products. Regulations on toy safety, for example, include provisions on labelling as well on materials that can be used in products. Non-compliance with these provisions constitutes different risks, because they can be defined by different probability factors and consequences. In general:

- A shipment can be non-compliant with one or more regulatory requirements.
- Non-compliance with different regulatory requirements can be treated as different non-compliance risks that may have different probability factors or different consequences, and thus different impacts on regulatory objectives.
- Separate targeting of every non-compliance type would be impractical in most cases, as it could overwhelm the system.

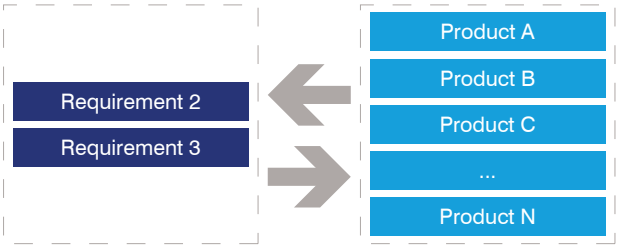
The following approaches to determine the cases of non-compliance in a targeting system can be applied:

- A non-compliance case can be defined as non-compliance with any applicable regulatory requirement. A shipment is considered non-compliant if it doesn't meet at least one regulatory requirement. 'A shipment contains non-compliant toys' is an example of application of this approach:

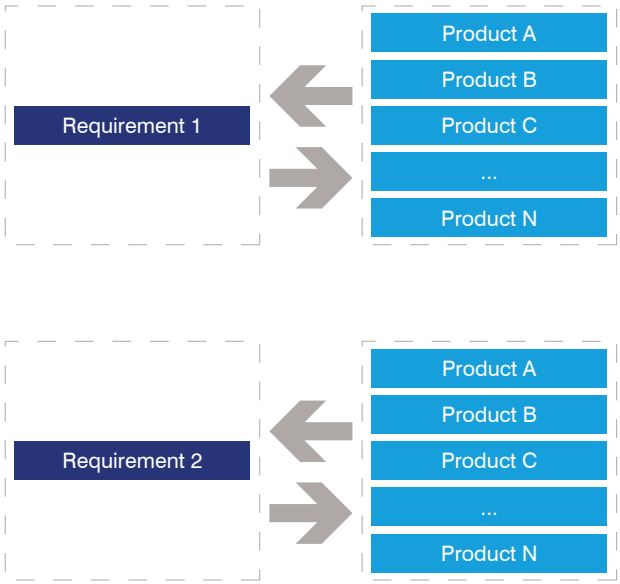


Though it is relatively easy to implement, a system based on such risk identification will treat a shipment with toys that are not properly labelled as non-compliant in the same fashion as those produced using dangerous materials.

- A non-compliance case can be defined as non-compliance with a set of regulatory requirements. A regulatory authority can choose which regulatory requirements are top priority and consider a shipment to be non-compliant only if any of these requirements are not met (if a shipment does not comply with other requirements, it will be considered compliant).



- A non-compliance case can be defined for every regulatory requirement. In this situation, the system will target each case of non-compliance separately:



Defining the cases of non-compliance within the scope of the targeting system can depend on:

- Priorities of the regulatory authority;
- Consequence of non-compliance with different regulatory requirements.

Evaluating the consequences of non-compliance

The consequences of non-compliance, or the level of harm associated with non-compliance, is a key parameter of a non-compliance risk, which alone can be used to set priorities in import compliance. The consequences of each case of non-compliance allow better understanding of which cases should be included in targeting.

As shown in Chapter 3, the consequences of non-compliance are generally inversely proportionate to the stringency of regulatory requirements. Determining the consequences of non-compliance depends on the nature of the regulatory requirements, and different approaches can be used in different economic sectors.

The consequences of non-compliance can be product- or shipment-specific. If regulatory requirements cover a set of products, one product can be more dangerous than another when it doesn't comply with the same requirements. In this case, the consequences of non-compliance – whether with a particular requirement or a set of them – should be evaluated per product. In many cases, the consequences of non-compliance can be evaluated on a shipment level, e.g. in case of non-compliance with most customs regulations.

The scale against which the consequences of non-compliance can be evaluated can be built using approaches similar to those described in Chapter 3. Approaches to build indices that allow product ranking according to the consequences of non-compliance are described in Chapter 6.

Determining the probability factors

Probability factors constitute the basis of any risk-based targeting system – they are the 'language' (the terms) in which compliance rules and risk profiles are built.

In classic risk management, when risks refer to events that may or may not happen, probability factors are called risk sources (which, in turn, are often referred to as hazards, dangers or vulnerabilities) – elements that alone or in combination with others can lead to risk.[79] Indeed, 'bad road' (a hazard) and 'unskilled driver' (a vulnerability) are sources of a risk 'car accident'. The key feature of risk sources is that they are considered to be certain. We know that the road is of bad quality and a driver is unskilled, and we use this knowledge to evaluate the probability of a car accident.

In targeting systems, which deal mainly with uncertainty that stems from a lack of knowledge about the actual status of evaluated objects (shipments in import compliance, defendants in court, patient in diagnostics), probability factors can be treated as positive or negative signs – an object's characteristics that can be used as evidence to make an educated judgement about its status.

Identifying probability factors is an indispensable part of any risk identification and should be done for every non-compliance risk. The model of non-compliance risk describes the following groups of probability factors that can be used as guidance in their identification. At least three main sets of questions are explicitly or implicitly considered when making a judgement on the probability that an incoming shipment contains a non-compliant product.[80]

These questions include:

- Is there anything new in the supply chain associated with the shipment – something that was not seen before: a new product, a new supplier, a new importer, etc.? Past experience reduces the level of uncertainty, so every new element in the supply chain increases the level of uncertainty associated with a shipment.
- How focused are the stakeholders involved in the import process associated with the product? The hypothesis behind this question is that when an importer or supplier works with a limited number of products, he or she has more experience and more knowledge about these products. As a result, the level of uncertainty associated with a shipment brought in by an importer focused on the imported products is lower than that of an importer who is working with a broader range of products, often changing his/her focus.
- What is the compliance history of the stakeholders associated with the incoming shipment? The compliance history is the main source of information/evidence that helps determine the probability of non-compliance. Clearly, it is more likely that an importer who had brought in many non-compliant goods would bring another non-compliant product than an importer who didn't have a non-compliance history.

Answers to these questions provide information that can be used as evidence on which the evaluation of probabilities can be based.

Likelihood of non-compliance

Targeting systems assess the likelihood of a shipment containing a non-compliant product. Approaches to evaluate probability and develop compliance rules are described in the following sections.

Developing risk profiles and compliance rules

One approach to evaluate the likelihood that a shipment (or some of its products) is non-compliant is developing risk profiles and compliance rules. The logic of the process is presented below:

A regulatory authority can choose from many approaches – from simple analytical tools to sophisticated predictive modeling – to consistently assess incoming shipments.

Gathering compliance history: Results of past inspections

The basic parameters of each shipment can be taken from accompanying documents and are known to the regulatory authority without any data processing. These commonly include country of import, HS code of the product and importer's name. Gathering basic historic data is essential to build a targeting system, no matter which tools to develop compliance rules and risk profiles the regulatory authority chooses to apply.

Regulatory authorities involved in border control have basic records about each incoming shipment. These records can be stored in different formats: from physical paper documents to various databases and information systems. Basic characteristics of shipments that are available to regulatory authorities differ, but they usually contain the following data:

- Shipment identifier
- Arrival date
- Product identifier (name or code)
- Name of the importer
- Name of the producer
- Port of entry
- Result of the inspection

Identifying the available sources of data and combining them into a single dataset is a prerequisite for developing compliance rules. Basic parameters of shipments (described earlier in the case study) that are used to illustrate each step of the targeting process are presented in the following table:[81]

Table 14 A case study: Parameters of shipments (history dataset)

Shipment number	Importer	Producer	Product	Country of orgin	Port of entrance	Actual status of the shipment
Shipment 1	Lucky import	The best toys	Scooters	A	B	Non-compliant
Shipment 2	Lucky import	The best toys	Scooters	A	B	Compliant
Shipment 3	Lucky import	We love toys	Pedal cars	E	B	Non-compliant
Shipment 4	Lucky import	We love toys	Pedal cars	E	B	Compliant
Shipment 5	Lucky import	Toys of the world	Scooters	C	D	Non-compliant
Shipment 6	Lucky import	Toys of the world	Scooters	C	D	Compliant
Shipment 7	Lucky import	The best toys	Dolls	A	B	Non-compliant
Shipment 8	Lucky import	Toys of the world	Dolls	C	D	Compliant
Shipment 9	Lucky import	We love toys	Pedal cars	C	D	Compliant
Shipment 10	Lucky import	We love toys	Scooters	C	D	Compliant

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

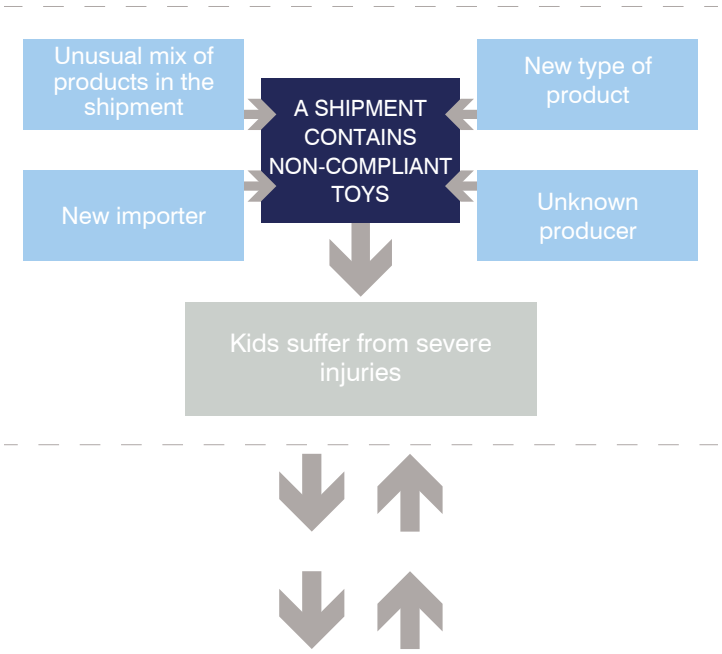
The dataset shows that the 10 shipments described in the case study were brought in by the importer, who is dealing with three types of products from three different producers in three different countries. The shipments arrived at two ports of entry and inspections reveal that four shipments did not comply with regulatory requirements.

This information can already be used to develop compliance rules and risk profiles. For example, one can see that two of three items produced by 'The best toys' were non-compliant. Using this data, a compliance rule 'Incoming shipments with products from the producer "The best toys" are of high risk' can be built. In practice, however, basic parameters characterizing a shipment are insufficient for building compliance rules and risk profiles, because they do not allow risk patterns to be identified.

Developing a data model of a non-compliance risk

The available data can be used efficiently if the dataset used to develop compliance rules follows the structure of the non-compliance risk. The figure below shows the logic of building a data model of a non-compliance risk.

Figure 27 Developing a data model of a risk



Shipment number	New Importer	Unusual mix of products	New type of product	Unknown producer	Status of the shipment
Shipment 1	1	1	1	1	Non-compliant
Shipment 2	0	0	0	0	Compliant
Shipment 3	0	1	1	0	Non-compliant
Shipment 4	0	0	0	0	Compliant
Shipment 5	0	0	1	1	Non-compliant
Shipment 6	0	0	0	0	Non-compliant
Shipment 7	0	0	0	0	Compliant
Shipment 8	0	0	0	0	Non-compliant
Shipment 9	0	0	0	0	Compliant
Shipment 10	0	0	0	0	Compliant

Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

To develop a data model of a risk, every probability factor of an identified risk (left part of the figure) should be turned into a data column, using the available parameters of the shipments as a basis. The datasets below – the first with basic parameters of the shipments and the second containing probability factors as shipment characteristics – show how a data model of a risk can be developed.

Lines in each dataset describe a shipment. The first table provides basic data about each shipment while the second table contains information that can be used as evidence to assess the likelihood that a shipment is non-compliant. For example, importer's name can be used, *inter alia*, to determine if a shipment was brought in by a new importer, someone who had little experience and whose knowledge about the regulations is not clear. This was identified as one of the probability factors of the risk.

Figure 28 Datasets show how to develop a data model of a risk

Shipment number	Importer	Producer	Product	Country of orgin	Port of entrance	Actual status of the shipment
Shipment 1	Lucky import	The best toys	Scooters	A	B	Non-compliant
Shipment 2	Lucky import	The best toys	Scooters	A	B	Compliant
Shipment 3	Lucky import	We love toys	Pedal cars	E	B	Non-compliant
Shipment 4	Lucky import	We love toys	Pedal cars	E	B	Compliant
Shipment 5	Lucky import	Toys of the world	Scooters	C	D	Non-compliant
Shipment 6	Lucky import	Toys of the world	Scooters	C	D	Compliant
Shipment 7	Lucky import	The best toys	Dolls	A	B	Non-compliant
Shipment 8	Lucky import	Toys of the world	Dolls	C	D	Compliant
Shipment 9	Lucky import	We love toys	Pedal cars	C	D	Compliant
Shipment 10	Lucky import	We love toys	Scooters	C	D	Compliant

Shipment number	New Importer	Unusual mix of products	New type of product	Unknown producer	New country of orgin	New port of entrance	New product producer	Status of the shipment
Shipment 1	1	1	1	1	1	1	1	Non-compliant
Shipment 2	0	0	0	0	0	0	0	Compliant
Shipment 3	0	1	1	1	1	1	1	Non-compliant
Shipment 4	0	0	0	0	0	0	0	Compliant
Shipment 5	0	0	0	1	1	1	1	Non-compliant
Shipment 6	0	0	0	0	0	0	0	Non-compliant
Shipment 7	0	0	1	0	0	0	1	Compliant
Shipment 8	0	0	0	0	0	0	0	Non-compliant
Shipment 9	0	0	0	0	0	0	0	Compliant
Shipment 10	0	0	0	0	0	0	1	Compliant

Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

There is only one importer in the example, so when the first shipment arrived, the importer was new to the regulatory authority. This is why the first shipment has '1' in the column 'new importer'.

Similar logic is used to turn data about producers into information that can be used to help target non-compliance. 'Unknown producer' is an example of a factor that might increase the level of probability that a shipment contains a non-compliant product, as products from unknown producers are associated with a higher level of uncertainty. A factor 'new product for producer' reflects the following logic: If a producer wants to enter a new market, there is higher probability that a mistake in compliance has been made than with products that were exported over long time periods.

Importantly, both datasets contain a column with the compliance status of each shipment. Analyzed together with probability factors, one can see which patterns – which combinations of shipment's characteristics – are more likely to result in non-compliance.

The term 'likelihood' is used to refer to the chance of something happening, whether defined, measured or determined objectively or subjectively, qualitatively or quantitatively, and described using general terms or mathematically (such as a probability or a frequency over a given time period).[82]

Analytical and risk-profiling approaches that can be used as formal tools that allow consistent evaluation of the probability (determined in different ways) that an incoming shipment is non-compliant using the available information include:

- Analytical approaches:
  - Using experts' judgement for shipment profiling
  - Using past frequencies of non-compliance to target incoming shipments
  - Using simple statistical probability that a shipment is non-compliant
- Risk-profiling approaches:
  - Using risk sources and risk factors as a basis to evaluate probabilities: hypothesis testing as a basis of shipment targeting
  - Predicting compliance as a machine learning task

Analytical methods to assess the probability of non-compliance

Using expert's judgement for shipment profiling

It is common to measure uncertainty associated with every shipment by using the expert's judgement, especially when no history data are available and a regulatory authority uses no formal risk management tools. It is impossible to inspect all incoming shipments and inspectors must be selective. Looking at an incoming shipment and using intuition, an experienced inspector can say 'I'm sure this shipment is non-compliant'.

A statement like this is an evaluation of likelihood that doesn't require any data to be processed (data are replaced by the inspector's intuition). Such an evaluation belongs on a scale that can contain similar expressions for other levels of uncertainty, such as:

- 'We are quite sure the shipment is compliant'
- 'We don't think the shipment is compliant'
- 'We are quite sure the shipment is non-compliant'
- 'We are absolutely sure the shipment is non-compliant'

If a regulatory authority wishes to apply expert's judgement to target non-compliant shipments, a scale of likelihoods similar to the one presented above should be developed. Such scales typically use the word 'likely': the shipment is 'highly likely', 'very likely', 'likely', 'unlikely' or 'very unlikely' to be non-compliant. When such scale is developed, experts can be asked to evaluate incoming shipments according to it, combining their experience of past inspections with information about an arriving shipment.

Challenges associated with this approach stem from its heavy reliance on subjective evaluations. Subjectivity and various perceptions of the same terms by different experts can lead to meaningless evaluations. Meanings of every descriptive term used to evaluate the likelihood of non-compliance should be explicitly defined. There are many possible biases that can influence estimates of likelihood, and care should be taken to understand the possible effects of individual (cognitive) and cultural biases.[83]

Using non-compliance frequencies

Another approach to assess the likelihood that an incoming shipment is non-compliant is using frequencies as a parameter according to which incoming shipments are targeted. Frequency is a number of events or outcomes per defined unit of time.[84] This estimate is rather easy to get: all that is needed is the number of cases in which the non-compliant shipments arrived in the past. Frequency can be calculated based on to past shipments and then as a measure of likelihood or probability of non-compliance for incoming shipments.

Frequency can be expressed in terms of 'non-compliant shipment arrives almost every day', 'only arrives once in a while' or 'only arrives once in a year'. Various scales can be developed and used to evaluate the likelihood of non-compliance based on frequencies.

Table 15 Frequency classes to assess likelihood of non-compliance

Frequency class	Frequency	Verbal description
1	Once in a week	Very frequently
2	Once in a month	Often
3	Once every half a year	Sometimes
4	Once a year	Seldom
5	Once in 10 years	Incredible

Source: Valentin Nikonov, table prepared to illustrate the methodologies described in the guide.

The only data required to estimate the frequencies and use them for targeting are:

Table 16 Using frequencies to gauge non-compliance likelihood (case study)

Shipment number	Date	Actual status of the shipment
Shipment 1	10 months ago	Non-compliant
Shipment 3	8 months ago	Non-compliant
Shipment 5	6 months ago	Non-compliant
Shipment 7	4 months ago	Non-compliant

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

If a regulatory authority has only this data for profiling, it can calculate the frequency of an incoming shipment as 'every two months' and use this as a probability of non-compliance.

Using frequencies requires minimum data, but can lead to substantial biases in the evaluation of probabilities of non-compliance. This evaluation doesn't require knowing the total number of shipments that arrived and is only based on the number of non-compliant shipments.

Using statistical probability

Estimating probability that an incoming shipment is non-compliant requires more data and more effort than estimating frequencies. It avoids biases associated with using frequencies and experts' opinions. Calculating the simple probability that the incoming shipment is non-compliant requires knowing two parameters: the total number of shipments that arrived within a certain time period and the total number of cases in which shipments were non-compliant.

The statistical probability of non-compliance in the toy case study is 40%, as 4 of 10 shipments were non-compliant. The only data needed to calculate the statistical probability are shown in the following table.

Table 17 Dataset needed to calculate statistical probability (case study)

Shipment number	Date	Actual status of the shipment
Shipment 1	10 months ago	Non-compliant
Shipment 2	9 months ago	Compliant
Shipment 3	8 months ago	Non-compliant
Shipment 4	7 months ago	Compliant
Shipment 5	6 months ago	Non-compliant
Shipment 6	5 months ago	Compliant
Shipment 7	4 months ago	Non-compliant
Shipment 8	3 months ago	Compliant
Shipment 9	2 months ago	Compliant
Shipment 10	1 months ago	Compliant

Source: Valentin Nikonov, table prepared to illustrate the methodologies described in the guide.

The statistical probability is the same as the interception rate – it gives an overall impression of the share of non-compliant shipments and can be used to evaluate the resources needed for the inspection. The main limitation of this approach is that knowing '4 of 10 shipments are non-compliant' on average doesn't provide any information about which of the next 10 shipments will be non-compliant. Targeted inspection requires tools described in the following sections.

Using predictive algorithms and risk-profiling approaches

Hypothesis testing

Hypothesis testing involves using known characteristics of shipments (probability factors) to evaluate the likelihood that the next shipment will be non-compliant. To illustrate the technique, the following dataset can be used as an example:

Table 18 An illustration of the hypothesis-testing technique (case study)

Shipment number	Date	Producer	Actual status of the shipment
Shipment 1	10 months ago	The best toys	Non-compliant
Shipment 2	9 months ago	The best toys	Compliant
Shipment 3	8 months ago	We love toys	Non-compliant
Shipment 4	7 months ago	We love toys	Compliant
Shipment 5	6 months ago	Toys of the world	Non-compliant
Shipment 6	5 months ago	Toys of the world	Compliant
Shipment 7	4 months ago	The best toys	Non-compliant
Shipment 8	3 months ago	Toys of the world	Compliant
Shipment 9	2 months ago	We love toys	Compliant
Shipment 10	1 months ago	We love toys	Compliant

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

The name of the producer can be used as an example of a probability factor to test the hypothesis 'shipments that contain products from producer "The best toys" are high-risk shipments'. To do so, the name of the producer should be used to calculate the statistical probability of non-compliance.

The Bayes rule[85] can be used to show how the producer influences the probability that a shipment is non-compliant. In the example, 'The best toys' produced two of four non-compliant shipments, 40% of shipments were non-compliant and 30% of all shipments came from this producer. This results in a conditional probability of 0.375 that the next shipment containing products from this producer will be non-compliant.

The benefit of this approach is that it allows selecting – or targeting – shipments for inspection based on their characteristics.

Import compliance as a machine learning task

The current level of development of IT tools for data mining and predictive modelling, as well as the availability of IT infrastructure at regulatory agencies, allow regulatory authorities to apply various statistical and machine learning tools to target non-compliant shipments. These tools, in essence, are based on similar concepts as those described in hypothesis testing section. They allow consideration of as many probability factors as required and processing of very large history datasets.

Data-mining tools can be used to implement an automated learning process that analyses huge amounts of data to give authorities a set of relevant compliance rules and risk profiles. To ensure that compliance rules reflect the actual situation, import targeting systems should be based on the concepts of machine learning.

A computer programme is said to learn from experience (E) with respect to some class of tasks (T) and performance measure (P), if its performance of tasks T, as measured by P, improves with experience E.[86] Targeting incoming shipments can be represented as a machine learning task:

- Task (T): classifying incoming shipments in terms of:
  - 0 – compliant shipment
  - 1 – non-compliant shipment
- Experience (E): results of past inspections (inspection history).
- Performance measure (P): number of shipments that were correctly evaluated.

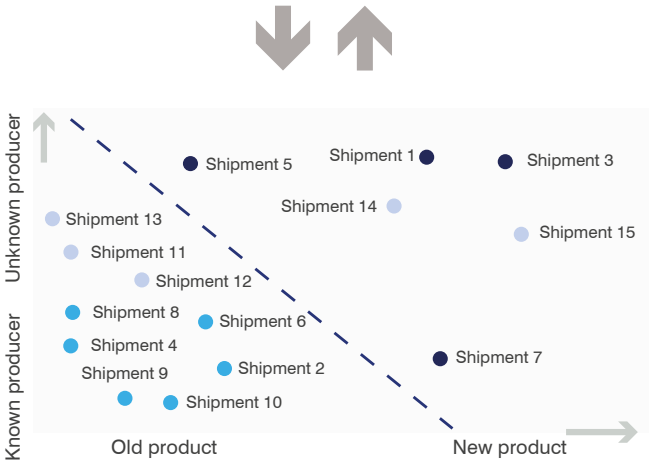
Machine learning tools provide automated solutions for discovering behavioural patterns and building risk profiles. In other words, they allow targeting of incoming shipments using many probability factors (shipment characteristics) at once.

To illustrate the principles of machine learning algorithms, which are similar to those of hypothesis testing, we will use a 'two probability factors' example.

The table with data model of the non-compliance risk (with information on each probability factor in case of each incoming shipment) of the toy case can be presented as in the figure below, in which dark blue circles represent shipments that were non-compliant, and blue circles represent shipments that were compliant and grey dots represent shipments that haven't yet been inspected:

Figure 29 Example of a graphical representation of a machine learning task

Shipment number	Date	Producer	Actual status of the shipment
Shipment 1	10 months ago	The best toys	Non-compliant
Shipment 2	9 months ago	The best toys	Compliant
Shipment 3	8 months ago	We love toys	Non-compliant
Shipment 4	7 months ago	We love toys	Compliant
Shipment 5	6 months ago	Toys of the world	Non-compliant
Shipment 6	5 months ago	Toys of the world	Compliant
Shipment 7	4 months ago	The best toys	Non-compliant
Shipment 8	3 months ago	Toys of the world	Compliant
Shipment 9	2 months ago	We love toys	Compliant
Shipment 10	1 months ago	We love toys	Compliant



Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

The placement of each dot on the graph represents the values of the two risk factors ('new product' and 'new producer') and shows how each factor in each case influences the outcome (compliant and non-compliant shipments). Drawing a straight line on the graph, which is supposed to separate in the best possible way the areas with red dots from areas with red dots, is a very simple example of a supervised machine learning algorithm. This algorithm can be used to predict the status of new shipments based on the same information, which is available before the shipment even arrives.

The graph shows that shipments containing products that were imported before and come from a known producer are compliant, while both shipments that contained new goods from unknown producers were non-compliant. If five new shipments (represented in the graph with grey dots) arrive, according to the developed model, those that are below the line have a high probability of being compliant, while the two shipments that are above the line represent the opposite.

In machine learning classification tasks, compliant and non-compliant shipments are examples of the two *classes*, while risk factors are referred to *attributes*. Assigning a class to an incoming shipment based on the available attributes is similar to other classification problems, such as e-mail classification (spam/not spam) and online transactions (fraudulent/not fraudulent).

The figure above shows a classification problem with only two classes and two attributes. The number of classes and the number of attributes can be much higher, however (the number of attributes can be even infinite, though this is hardly needed within regulatory contexts). All predictive algorithms, no matter how complicated they may seem, are used to formulate a hypothesis or build a 'decision boundary' and indeed solve the same problem: they separate the classes based on the known attributes.

Various predictive algorithms differ in how they perform the task: they can be linear (when a straight line is used to separate the two classes) and more complex functions and approaches can be used (such as random forests or neural networks).

Most of the mathematics in the machine learning theory focus on how to best represent a class by the available attributes – how to build a model that will give the right answers. The current level of development of IT tools makes it relatively easy to apply even most complicated predictive algorithms and doesn't require actual knowledge about how they work.

Predictive algorithms that are most commonly used in regulatory environments include decision trees, random forests and logistic regression. These algorithms can be interpreted and represented as a set of conditional statements (rules). The figure above allows formulation of the following simple rules, which make it possible to evaluate new incoming shipments and make predictions on whether they are non-compliant:

- 'Shipments that contain products that have not been inspected before and were produced by unknown producers are non-compliant.'
- 'Shipments that contain known products that were produced by known producers are compliant.'

Predictive models, including compliance rules in the example above, can have different predictive quality and need to be evaluated before they are implemented.

Building a classification model is challenging, both in terms of the 'length' and the 'width' of the dataset. It requires running simulations on the available data, which are usually divided into three parts:

- Training set: used to develop compliance rules
- Test set: used to test how the compliance rules work and to evaluate the algorithm
- Validation set: used to validate the rules

To illustrate the concept, we assume that a regulatory authority from the toy case study has data only on 10 shipments that were inspected in the past. The regulatory authority can use the whole table to develop rules, but in this case, it will need to accept them without any tests.

The usual approach to test compliance rules is to run a serious of simulations to answer the question 'What would have happened if we had inspected the shipments according to the compliance rules?'. As the actual results of the inspections are known, such simulations provide all the information required to evaluate how good the rules are in terms of the two regulatory errors described in the beginning of this chapter.

The regulatory authority uses the probability factor to combine information on the product and producer in one variable 'new product for producer'. To develop compliance rules, the authority would use only the first six lines of the table and test the compliance rules by applying them on the four last lines.

As the figure above shows, both shipments for which the factor 'new product for producer' is relevant were non-compliant, so it can be used as a rule for targeting non-compliance. If before applying this rule to new shipments, the authority wanted to know what would have happened if it applied the rules for the last four months, it would get the following results:

Figure 30 Example of results of a simulation to test compliance rules

Shipment number	Date	Producer	Product	New product for producer	Actual status of the shipment
Shipment 1	10 months ago	The best toys	Scooters	1	Non-compliant
Shipment 2	9 months ago	The best toys	Scooters	0	Compliant
Shipment 3	8 months ago	We love toys	Pedal cars	1	Non-compliant
Shipment 4	7 months ago	We love toys	Pedal cars	0	Compliant
Shipment 5	6 months ago	Toys of the world	Scooters	1	Non-compliant
Shipment 6	5 months ago	Toys of the world	Scooters	0	Compliant

Shipment number	Date	Producer	Product	New product for producer	Actual status of the shipment	Simulation results (Rule "New product for producer")
Shipment 7	4 months ago	The best toys	Dolls	1	Non-compliant	Non-compliant
Shipment 8	3 months ago	Toys of the world	Dolls	1	Compliant	Non-compliant
Shipment 9	2 months ago	We love toys	Pedal cars	0	Compliant	Compliant
Shipment 10	1 months ago	We love toys	Scooters	1	Compliant	Non-compliant

Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

Simulations allow the regulatory authority evaluate the quality of compliance rules. If shipment 7 were assessed according to the rule 'shipment containing a product that is new for the producer', it would be deemed a high-risk shipment and its compliance status would be 'non-compliant'. This was the first case in which the shipment contained dolls made by the company 'The best toys', so the factor 'new product for producer' is relevant. In this case, the assessment of the shipment would be correct – the actual status of the shipment is 'non-compliant'.

Shipment 8 also contains dolls, but was produced by 'Toys of the world'. Before the arrival of this shipment, 'Toys of the world' was known to the regulator as a producer of scooters. In this case, dolls also meets the compliance rule 'a new product for producer' and the assessment of the shipment is 'high-risk'. In reality, though, shipment 8 was compliant, and if it hadn't been inspected, it would not have exposed consumers to unnecessary risks.

In case of shipment 9, the system also made the right guess – the shipment was assessed as low-risk and indeed it was compliant, whereas shipment 10 is similar to shipment 8.

In machine learning, evaluation of predictive algorithms is performed by the means of false-positive analysis. Classification can be:

- True positive (the algorithm guessed 'non-compliant shipment', shipment was indeed non-compliant, as in case 7);
- False positive (the algorithm guessed 'non-compliant shipment', but shipment was compliant, as in cases 8 and 10);
- True negative (algorithm guessed 'compliant shipment', the shipment was indeed compliant, as in case 9);
- False negative (the algorithm guessed 'compliant shipment', but shipment was non-compliant).

Building a confusion matrix is a convenient way to perform false-positive analysis. In case of the simulation described above, the confusion matrix would be like the following:

	Shipment assessed as high-risk (non-compliant)	Shipment assessed as low-risk (compliant)
Non-compliant shipment in reality	1	0
Compliant shipment in reality	2	1

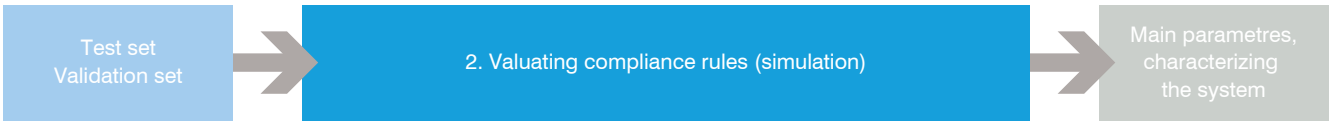
The matrix shows that one of three shipments that were compliant in reality was assessed by the compliance rule as compliant, while the other two were evaluated as non-compliant. At the same time, one non-compliant shipment was evaluated as high-risk.

Precision and recall are two main parameters that are used to evaluate classification algorithms. Precision is an evaluation of how often the algorithm causes a false alarm: it shows what part of all consignments that the algorithm has predicted as non-compliant were actually non-compliant. Calculating precision requires dividing the number of true positives by the number of predicted positives. The higher the precision, the better the algorithm. In the example, precision is 33% (one out of three shipments that were targeted as non-compliant was indeed non-compliant).

Recall shows the sensitivity of the algorithm. It shows how many non-compliant shipments the algorithm correctly detected. Calculating recall requires dividing the number of true positives by the number of actual positives (true positives and false negatives). In the example, recall is 100% (the algorithm correctly identified the only non-compliant shipment).

The following section shows how the false positive analysis can be performed in the context of an import compliance targeting system.

Evaluating compliance rules



False-positive analysis provides the regulatory authority with four of nine characteristics of a risk-based regulatory regime that were introduced earlier in the chapter. Indeed, the true-positive parameter of false-positive analysis corresponds to the number of inspected non-compliant shipments, and false positive to number of non-compliant shipments released without an inspection.

Table 19 Evaluating risk-based compliance strategy against benchmarks

Parameter, characterizing a targeting system	Comments	System targets every shipment as high-risk	System targets every shipment as low- risk	Compliance rule
Number of incoming shipments	Total number of shipments within a given period.	4	4	4
Non-compliance rate	Percentage of non-compliant shipments.	25%	25%	25%
Inspection rate	Percentage of incoming shipments inspected.	100%	0%	75%
Inspection units	Resources of regulatory authority invested in inspections (man-hours).	4	0	3
Number of inspected non-compliant shipments (targeted as high-risk)	Number of shipments that the system correctly identified as non-compliant. Represents losses, prevented by the targeting system.	1	0	1
Number of inspected compliant shipments (targeted as high-risk)	Shipments that the system identified as non-compliant but that were compliant as the result of an inspection; represents resources that could have been invested in high-risk shipments.	3	0	2
Number of released non-compliant shipments (targeted as low-risk)	Non-compliant shipments that were targeted as low-risk and released without inspection (actual number of such shipments is often unknown). Represents losses associated with the consequences of non-compliance.	0	1	0
Number of released compliant shipments (targeted as low-risk)	Number of compliant shipments that were correctly classified as low-risk by the system and released without inspection.	0	3	1
Border compliance time	Time that a shipment is held at the border awaiting an inspection, during the inspection and the follow-up (as in the case study we assume that border compliance time is 150% of inspection duration).	6 hours	0	4.5

Source: Valentin Nikonov, table prepared to illustrate the methodologies described in the guide.

False negative characterizes the number of compliant shipments that were targeted as high-risk and inspected, whereas true negative corresponds to the number of compliant shipments that were targeted as low-risk and released without an inspection. The number of non-compliant shipments that were targeted as low-risk and released without an inspection represents the residual risk associated with an import compliance regime – it can be used as an estimate of potential losses caused by the consequences of non-compliance.

Determining the tolerable level of residual risk is challenging for any regulatory authority. Risk management doesn't provide guidance on how much risk to tolerate; it is a decision that depends on societal expectations, policy objectives and the risk propensity of a regulator. From the risk management perspective, it is important to ensure that the residual risk is to the resources of a regulatory authority allocated to border inspection and border compliance time.

Results of false-positive analysis can be reviewed together with other key characteristics of a targeting system. These are general parameters, such as the number of incoming shipments and inspection rate and those characterizing the costs of safety: the number of inspection units needed to achieve the given level of residual risk for the regulatory authority and border compliance time (for importers).

Compliance rules can be evaluated by comparing the results of a simulation with certain benchmarks, e.g. a regulatory regime in which every consignment is targeted as high-risk, or the opposite case – a regulatory regime in which every consignment is released without an inspection.

Table 20 Illustration of training, test and validation sets

Shipment number	Date	Probability factor 1	Probability factor 2	Probability factor 3	Probability factor N	Compliance status
Shipment 1	3 years ago	Traning set				1
Shipment 2	3 years ago					0
Shipment 3	3 years ago					0
Shipment 4	3 years ago					0
Shipment 5	2 years ago					0
Shipment 6	2 years ago					1
Shipment 7	2 years ago					0
Shipment 8	2 years ago					0
Shipment 9	2 years ago					1
Shipment 10	2 years ago					0
Shipment 11	2 years ago					0
Shipment 12	1 years ago	Test set				0
Shipment 13	1 years ago					1
Shipment 14	1 years ago					0
Shipment 15	1 years ago					0
Shipment 16	1 years ago					1
Shipment 17	This year	Validation set				0
Shipment 18	This year					1
Shipment 19	This year					0
Shipment 20	This year					0

Source: Valentin Nikonov, table prepared to illustrate the methodologies described in the guide.

Any regulatory regime based on compliance rules should be compared with at least two benchmarks. Comparing compliance rules with a regulatory regime that assumes inspection of every shipment, we see that compliance rules are more efficient, as this regime requires fewer resources and leads to the same result (the non-compliant shipment was identified at the border).

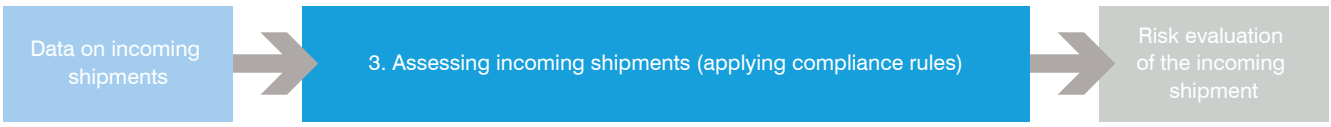
Comparing compliance rules with the second benchmark – not inspecting any shipment – we see that achieving zero border compliance time and not investing any resources in import inspection would result in the release of one non-compliant shipment. Compliance rules would intercept this shipment, but there would be additional costs of inspecting two compliant shipments and an increase in border compliance time.

Depending on the nature of the non-compliance risk and the risk tolerance level of a regulatory authority, either of the two scenarios can be chosen. If, to bring the border compliance time to zero, a regulatory authority is willing to tolerate the risk of one non-compliance shipment being released, the 'not inspecting every shipment' scenario can be implemented. If, however, regulator is willing to mitigate the risk of releasing even one non-compliant shipment, implementing compliance rules would be an appropriate strategy. As shown above, this strategy would be more efficient than inspecting every shipment.

A validation set is commonly used to evaluate compliance rules. A validation set is similar to a test set and contains data on shipments with known compliance statuses.

Usually, 60% of available data are used to train the model or develop compliance rules, 20% are used for the test set and 20% for validation.

Assessing incoming shipments



Assessing incoming shipments according to compliance rules or risk profiles requires a separate process. To illustrate the main function of the process, we assume that the regulatory authority adopted the regulatory regime that can be formulated as follows:

- All shipments that contain a combination 'product–producer' that has not been seen before is a high-risk shipment.
- All shipments that do not belong to the first group are low-risk shipments.

The regulatory authority received basic information on three shipments:

Table 21 Data on incoming shipments (case study)

Shipment number	Importer	Producer	Product	Country of orgin	Port of entrance
Shipment 11	Lucky import	Toys of the world	Dolls	C	D
Shipment 12	Lucky import	Toys of the world	Scooters	C	D
Shipment 13	Lucky import	Toys of the world	Scooters	A	B

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Table 22 Predicting compliance status of incoming shipments

Shipment number	Date	Importer	Producer	Product	New product for producer	Predicted compliance
Shipment 11	Tomorrow	Lucky import	Toys of the world	Dolls	0	Compliant
Shipment 12	Tomorrow	Lucky import	Toys of the world	Scooters	0	Compliant
Shipment 13	Tomorrow	Lucky import	Toys of the world	Scooters	0	Compliant

Source: Valentin Nikonov, table prepared to illustrate the methodologies described in the guide.

Figure 31 Logic of data processing for applying risk profiles

Data on incoming shipments

Shipment number	Importer	Producer	Product	Country of orgin	Port of entrance
Shipment 11	Lucky import	Toys of the world	Dolls	C	D
Shipment 12	Lucky import	Toys of the world	Scooters	C	D
Shipment 13	Lucky import	Toys of the world	Scooters	A	B

Data on incoming shipments with data on probability factors

Shipment number	Date	Importer	Producer	Product	New product for producer	Predicted compliance
Shipment 11	Tomorrow	Lucky import	Toys of the world	Dolls	0	Compliant
Shipment 12	Tomorrow	Lucky import	Toys of the world	Scooters	0	Compliant
Shipment 13	Tomorrow	Lucky import	Toys of the world	Scooters	0	Compliant

Data on incoming shipments with adta on probability factors

Compliance rules/risk profiles formulated in terms of probability factors

History dataset with probability factors

Shipment number	Date	Probability factor 1	Probability factor 2	Probability factor 3	Probability factor N	Compliance status
Shipment 1	3 years ago	Traning set				1
Shipment 2	3 years ago					0
Shipment 3	3 years ago					0
Shipment 4	3 years ago					0
Shipment 5	2 years ago					0
Shipment 6	2 years ago					1
Shipment 7	2 years ago					0
Shipment 8	2 years ago					0
Shipment 9	2 years ago					1
Shipment 10	2 years ago					0
Shipment 11	2 years ago					0
Shipment 12	1 years ago	Test set				0
Shipment 13	1 years ago					1
Shipment 14	1 years ago					0
Shipment 15	1 years ago					0
Shipment 16	1 years ago					1
Shipment 17	This year	Validation set				0
Shipment 18	This year					1
Shipment 19	This year					0
Shipment 20	This year					0

Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

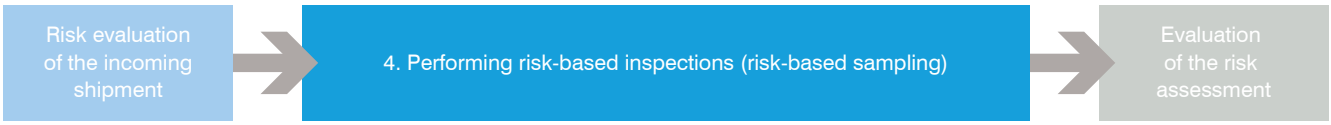
The first two shipments contain dolls and scooters produced by 'Toys of the world', and the third contains scooters made by 'The best toys'. The actual status of the shipments is unknown. To evaluate the probability that each shipment is non-compliant, the regulatory authority uses compliance rules that were developed based on an analysis of the history data.

In the example, to apply the rule, the regulatory authority needs to know if a shipment contains a product type that is new for the producer – in other words, that the combination 'producer-product' never appeared in the table with history data. In the simple case, one can easily check each combination associated with every incoming shipment to see if dolls produced by 'Toys of the world' and scooters made by 'The best toys' and 'Toys of the world' were ever imported. According to the compliance rules adopted by the regulatory authority, the incoming shipments are low-risk and their release can be expedited.

Compliance rules are formulated in terms of probability factors (e.g. 'new importer'), while data on incoming shipments contains basic information, such as numbers and names of stakeholders ('importer's name'). To apply compliance rules to the incoming shipments, the values of the probability factors should be calculated. The regulatory authority should know not just the name of the importer, but also the value of the probability factor (whether the importer is new or not).

To this end, data from the history dataset should be processed and combined with data on the incoming shipments. When data on the incoming shipments are enriched by the probability factors, compliance rules can be applied and the values of 'predicted compliance' appear in the table.

Performing risk-based inspections



Zero risk or absolute safety cannot be a valid regulatory objective, even with inspection of every shipment. Any inspection implies sampling, so the level of scrutiny of an inspection and a respective regulatory regime are determined by the following parameters:

- Tolerance level, or the level of detection, which is the measurable level of the prevalence of non-compliant products that regulators are willing to accept;
- Confidence level, which is the level of certainty that sampling will detect the level of the prevalence of non-compliant products that exceeds the tolerance level.

The sampling plan should reflect the non-compliance risk of an incoming shipment in the following way:[87]

a. The confidence level should reflect the probability of non-compliance associated with an incoming shipment;

b. The level of detection should reflect the consequences of non-compliance associated with the incoming shipment.

Inspections have three main parts: documentary checks, identity checks and physical checks. In many regulatory contexts, the scope of the risk-based import compliance system contains only physical checks; documentary and identity checks are obligatory.

Risk-based inspections allow resources from low-risk shipments to be shifted to those with higher levels of risk. When shipments can be categorized in terms of non-compliance risk, the regulatory authority can assign the following parameters to each risk group:

- Inspection frequency, or inspection rate;
- Sample size, as it is usually not feasible to inspect entire consignments and inspections are carried out mainly on samples obtained from a consignment. To determine the number of samples to be taken, the regulatory authority should select a confidence level (for example, 95%), a level of detection (for example, 5%) and an acceptance number (for example, zero), and determine the efficacy of detection (for example, 80%). A sample size can be calculated from these values and the lot size.

For a given acceptance number and efficacy of detection, a risk-based inspection scheme can be defined using the following structure:

Table 23 Example of a risk-based sampling plan

	High consequences of non-compliance	Moderate consequences of non-compliance	Low consequences of non-compliance
High probability of non-compliance	Frequency: every shipment Level of detection: 0.1% Confidence level: 99%	Frequency: 50% Level of detection: 0.5% Confidence level: 99%	Frequency: 25% Level of detection: 1% Confidence level: 95%
Moderate probability of non-compliance	Frequency: every shipment Level of detection: 0.1% Confidence level: 95%	Frequency: 50% Level of detection: 0.5% Confidence level: 95%	Frequency: 10% Level of detection: 1% Confidence level: 90%
Low probability of non-compliance	Frequency: 50% Level of detection: 0.1% Confidence level: 90%	Frequency: 25% Level of detection: 0.5% Confidence level: 90%	Frequency: 5% Level of detection: 5% Confidence level: 80%

Source: Valentin Nikonov, table prepared to illustrate the methodologies described in the guide.

The following logic is used to structure the sampling plan: The level of harm associated with the consequences of non-compliance is reflected by the acceptable number of non-compliant products in the consignment, represented by the parameter 'level of detection' (the higher the consequences, the lower the level of detection).

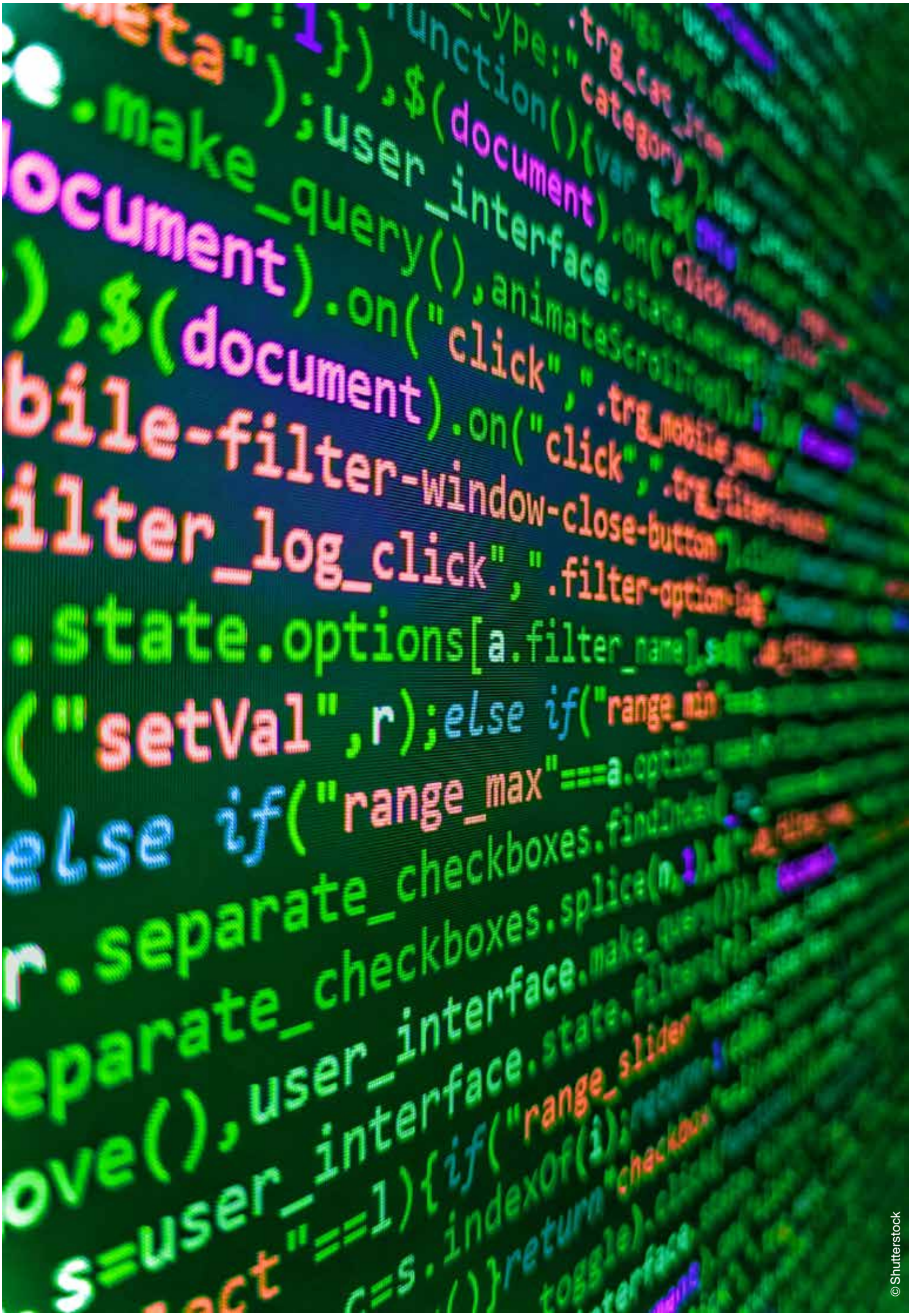
Shipments that contain products associated with high consequences, for example, can be assigned 0.1% of allowed non-compliant products (the most stringent case in most of the sampling standards). Shipments containing products with moderate consequences of non-compliance can be inspected according to 0.5% level of detection. If the consequences of non-compliance are low, the detection level could be in the 1%–5% range. Other things being equal, a lower level of detection means a bigger sample and therefore higher inspection costs.

Probability of non-compliance is associated with the parameter that represents the likelihood that the number of non-compliant products in the shipment is not higher than the level of detection, or confidence level (the higher the probability of non-compliance, the higher the confidence level). Shipments with high probability of non-compliance can be inspected with the confidence level of 99%, those of moderate probability – 95%, etc.

Updating the datasets

Information on whether a shipment was inspected and the results of the inspection are added to the dataset, so the compliance rules can be regularly evaluated. The three incoming shipments in the example were released without an inspection, so the regulatory authority doesn't know their actual status within an import compliance framework.

If information on non-compliant products is received during later stages of market surveillance (non-compliant goods found on the market), it should be traced back so it is included in the datasets that are used to develop compliance rules.



Chapter 5

Targeting customs risks

Targeting customs risks

Non-compliance risks under the customs authority's responsibility

Institutional arrangements and procedures

The increase in cross-border transactions and the importance of global trade for national economies are motivating governments to develop more efficient border management procedures. Customs authorities increasingly play a more important role in managing international trade, and outdated working practices can restrict the efficiency of customs and other border agencies.

Inefficiency and out-of-date procedures not only prevent effective revenue collection and pose a risk to security, but they also hinder foreign trade. In a competitive international business environment, the private sector finds it cumbersome and discouraging to conduct business or invest in a country where goods cannot move safely and quickly across borders. Effective clearance and controls can link national industries to the global supply chain and be an attractive feature for direct foreign investment.

Creating the necessary operational capacity is the toughest task for any administration undergoing reform. Cross-border regulatory agencies must demonstrate their ability to manage and control external borders effectively and efficiently in the interest of both the citizens and trade operators.

Globalization, increased trade and greater traffic volumes force cross-border regulatory agencies to harmonize rules and procedures as much as possible. Another new challenge is the key role that cross-border regulatory agencies must play to ensure the security of the international supply chain, which calls for closer international cooperation and harmonized and modernized procedures, practices and processes.

At the same time, business operators expect trade facilitation measures to ensure efficient procedures and controls based on risk management, as well as short border crossing times. To minimize costs, data and documentation requirements, and the time necessary to complete border formalities, the cross-border regulatory agencies should work paperless, and the single window and one-stop shop approach should be implemented.

Only stable, efficient, flexible and competent government administrations will be able to meet these challenges. It would be useful to consider new priorities and challenges while building up the necessary organizational and operational capacity, which might influence state revenue.

The challenge for customs and other border agencies is to stop threats while facilitating legitimate trade and transport across borders. The rising volume of cross-border transactions has pressured administrations in many countries to modernize their legislation and structures. Introducing risk management that supports allocation of limited resources to the highest risk areas and focuses on non-compliant traders would help agencies cope better with bigger trade volumes and decreasing human resources.

In managing risks, a balance must be struck between costs and benefits, as clearly it will not be cost effective to address all risks equally. New requirements for security and revenue collection as well as the growing demands of traders for faster, safer and more reliable services have means modern processes must be introduced, which often means modernizing laws and administrations.

Risk management process and implementation

Risk management in customs control has a long and rich history. Customs authorities have been world leaders in applying formal risk management in regulation and standardizing risk management globally. The concept of customs controls of the World Customs Organization (WCO) requires the latter to be 'carried out on a selective basis using risk management techniques to the greatest extent possible'. The risk management goals declared by the WCO follow the risk management triangle's principles, which include:

- Ensuring more effective use of available resources;
- Increasing ability to detect offences and non-compliant traders and travelers;
- Offering compliant traders and travelers greater facilitation;
- Expediting trade and travel.

The WCO has developed a wide range of instruments to help ensure efficient management of risks at the border. These instruments are compatible with and complementary to the TFA.

Through the provisions of the revised Kyoto Convention, the WCO was essentially attempting to achieve general adoption of a risk-managed style of regulatory compliance.

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As a result of international cooperation and the risk management standardization work of the WCO and other international organizations, customs risk management systems form the natural basis of integrated risk management at the border. These risk management system are based on a standardized data model.[88] In many countries, data processing and risk management tools are based on the United Nations Conference on Trade and Development's Automated System for Customs Data (ASYCUDA).[89]

Targeting systems of customs authorities are based on the same processes described in the previous chapter. The way customs can apply these processes to form the basis of an integrated risk management system is described in the following pages.

Cooperation and information exchange

All border regulatory agencies must engage with customs from time to time, so proactive engagement between agencies is crucial. The main goal of this cooperation is to ensure that the government response to the challenges of supply chain security is both efficient and effective, by avoiding duplication of requirements and inspections, streamlining processes and ultimately working towards global standards that secure the movements of goods in a manner that facilitates trade.[90]

National policies should be in place to ensure that the cross-border regulatory agencies cooperate and coordinate their activities to guarantee compliance and promote economic development in more proactive ways. However, coordination and cooperation among cross-border regulatory agencies is often lacking.

A reform limited to customs will be substantially less effective if other agencies and service providers, which participate in the trade logistic chain, are not performing better. All border agencies should join forces with customs to apply advanced risk-profiling methodologies to reduce intrusive inspections.

The number of government agencies that develop and enforce policy, controls and procedures is less important than how they exchange information. Also critical is whether they work separately or are integrated using a 'whole of government' approach. Lack of coordination between government agencies involved in controlling cross-border transactions encumbers trade.

Trading parties often must adapt not only to different types of information being requested but, more importantly, to the same information being requested in different formats or at different times. This fragmentation of requirements increases not only the risk of mistakes, but also the cost of transactions. Moreover, border regulatory agencies are less effective if different organizations collect the same information several times.

Cooperation between the agencies operating at borders would lead not only to better processing efficiency, but also to substantial financial savings. However, coordinating government border activities require combining many different functions, cultures and organizations.

The key benefits for border agencies include a reduction in administration and enforcement costs through:

- Process reengineering to streamline and harmonize procedures;
- Empowering staff across agencies to share responsibilities;
- Coordinated risk management: shared information for shared decisions on high-risk cargo;
- Sharing of non-intrusive inspection equipment and inspection bays (e.g. integrated check posts and mirror image facilities across borders).

The key benefits for the trading community include:

- Lower compliance costs through streamlined and simplified procedures;
- Greater efficiency in inspection and release of phytosanitary goods;
- Improved quality of services provided by border agencies;
- Expedited border crossing thorough harmonized physical inspections; improved flow management.[91]

Technology support

Even though general information technology infrastructure is established in many cross-border regulatory agencies, risk management-specific IT and tools are not always available. Risk management does not require expensive computer systems or software. As long as the flow of high-quality information is assured, proper decisions can be made about risk management. Computer systems may expedite the process, but they are not mandated.

Nevertheless, an integrated IT system environment might support the business strategy of the administration and would facilitate trade, help manage risk and ensure that business is organized as efficiently as possible.[92]

Inputs into the targeting system of customs

Types of customs non-compliance risks

Customs administrations have two primary roles: revenue collection and the security of citizens in terms of health, the environment, products, intellectual property rights, etc. Trade facilitation has been added to customs objectives in recent years, and customs administrations are increasingly taking over security roles including the one underpinning the WCO SAFE framework of standards.

Both the objectives of customs administrations and the risks they manage continuously evolve.

Table 24 Origin of risks for different customs objectives

	Revenue collection	Public health	Environmental protection	Fight against terrorism	Fair competition
Non-declared goods	x	x	x		x
Proper tariff classification	x	x	x		x
Proper valuation	x				x
Proper country of origin	x				x
Trade policy measures		x	x	x	
Proper customs procedures	x	x	x		
Intellectual property rights		x			x
Trade agreements compliance	x				x
Money laundering				x	

	Revenue collection	Public health	Environmental protection	Fight against terrorism	Fair competition
Environmental crime		x	x		
Smuggling					
Drugs and precursors		x			
Weapons of mass destruction		x	x	x	
Firearms		x		x	
CITES			x		
Nuclear and radioactive materials		x		x	
High customs duty goods	x	x	x		

Source: Zivkovic, A., and Sutevski, D. (2018). *Facilitating Trade: Improving Customs Risk Management Systems in the OIC Member States*.

Probability factors for targeting non-compliance risks

The WCO has developed a risk management methodology – including methods for risk assessment, profiling and targeting – to help authorities effectively manage such a broad set of risks. The methodology, described in the WCO Customs Risk Management Compendium,[93] includes a set of general high-risk indicators, a description of the process for standardized risk assessment and model risk profiles.

'Risk indicator' is another term used for a probability factor of a non-compliance risk. A risk indicator is specific criteria that, when taken together, serve as a practical tool to select and target movements that pose a risk of potential non-compliance with customs laws. These criteria enable the authority to assess the probability that a transaction is non-compliant. Risk indicators are used to develop compliance rules or build risk profiles.

Probability factors for non-compliance risks generally include characteristics of the stakeholders in a supply chain who are associated with a trade transaction. Ensuring that the list of stakeholders is comprehensive enables customs to identify all probability factors. The UN/CEFACT buy-ship-pay model describes four main categories of supply chain actors: customer, supplier, intermediary and authority:

Table 25 Categories of supply chain actors

Customer	Supplier	Intermediary	Authority
Buyer	Seller	Transport service provider	Customs authority
Invoicee	Invoicer	Bank	Environmental agency
Payor	Payee	Credit agency	Agricultural agency
Importer	Exporter	Insurer	Chamber of commerce
Final consignee	Original consignor	Customs agent	Consular authority
Transport services buyer	Transport services seller	Carrier agent	Inspection agency
Ship to	Ship from	Commission agent	Port health
	Manufacturer	etc.	etc.

Source: UN/CEFACT (2013).

A customs supply chain is widely classified as a complex system, due not only to the large number of actors, but also their complex structural links – the interaction between these actors. It incorporates all aspects of moving cargo from the exporter through the transport process, the logistics operations and border control (declaration processing, custom clearance, data analysis, risk assessment, document checking, scanning, physical inspection, etc.) to the final importer.

The economic, political and social impacts of various risks are highly detrimental to countries, businesses and the public. This is why risk management in the customs supply chain context is becoming a crucial issue to ensure sustainability, safety and performance. The risk management-based approach as systematic identification and implementation of all measures necessary to limit exposure to customs risk determines which people, goods and means of transport should be examined and to what extent.

Accordingly, it is important to use a risk assessment approach and effective analysis of the risk faced in the customs context so decision makers can understand the capabilities and resources that need to be deployed to successfully implement risk management in the customs supply chain.[94]

General high-risk indicators, which alone or in combination can be used to develop compliance rules and build risk profiles, are grouped in the WCO Customs Risk Management Compendium according to the sources of data, from which information regarding these indicators can be gathered. The main groups of indicators include:

- Carrier manifest
- Country
- Commodity
- Transportation
- Container
- Business entity (local)
- Business entity (shipper)

Carrier manifest detail

A carrier is at risk if any of its crew are associated with terrorist or criminal organizations (carrier profile). In terrorist-related and smuggling activities, the principal concern is accurate identification of country of origin, the transhipment country and the method of transport. This information is part of the carrier manifest.

Data required in this regard concern the commodity, its origin, the route and packing. Shipper and consignee information is less reliable; these data are reported to the carrier, independent of the carrier's integrity, and are therefore subject to manipulation and inaccuracy.

High-risk country identification

The second risk factor is the originating country and transhipment country. Intelligence sources for countries posing a risk for smuggling-related activities determine the level of threat for a specific country. The general conditions for identifying high-risk countries are:

- Cooperation with the United Nations is poor or non-existent. One example would be if no counter-narcotics measures are in effect;
- Level of corruption among both high- and low-ranking government officials is high;
- Toleration of extremist groups sympathetic to terrorist activities;
- Absence of money-laundering legislation;
- The government does not have strict controls to prevent diversions of essential or precursor chemicals. This would indicate that other dual-use products could easily be diverted or facilitated.

Commodity and transport

The transport mode selected by traders is closely connected to the type of commodity. As such, the following factors giving rise to international trade risks are interrelated:

- Shipment has unusual routing or is not cost-effective;
- Shipment is a consolidation with no identifiable participants;
- Packing method for commodity is not usual, i.e. product is normally packed in cartons but is now in drums, or the commodity is not usually palletized and shrink-wrapped and is now packed in this manner;
- Shipment contains high-risk commodities in the dangerous goods category.[95]

Container aspects

This risk attribute concerns situations where details about the container give rise to concern. For example:

- Number on the security seal is different from number on the bill of lading;
- Invalid container number (check-digit);
- Unusual open spaces in the load;
- Container type inconsistent with goods;
- Temperature in reefer is abnormal for commodity;
- Unusual weight for container size.

Importer/exporter aspects

This risk attribute relates to the consignee (the buyer/recipient of the shipment). Specific warning signs include:

- The identity of the consignee is not previously known (can be determined through research);
- The consignee is very recent. The importer may be attempting to establish an importing history before starting smuggling activity;
- Address is suspect. The address may not fit the import – i.e. if it is a commercial shipment for a residential area, if the address does not exist, if the address has P.O. Box, if the address is in a suspect area or if the address is incomplete;
- Sudden large importation for a new or relatively recent importer, indicating deviation from the usual trade pattern;
- One-to-one relationship: importer is the same as exporter (groups, common directors, etc.);
- Previous enforcement (compliance history: recovery, difference between assessed and declared parameters);[96]
- Inadequate capacity or resources for importer to import goods (the import value is substantially out of proportion to the business size);
- Inconsistency with previous importation patterns;
- An unusual commodity for importer, exporter or vendor.

Shipper aspects

The last risk factor relates to attributes of the shipping entity itself. Warning signs might include:

- Shipper has never been seen previously, as determined by research;
- Shipper is established, but now has a new manufacturer ID with a new foreign address;
- No phone listing exists for foreign business (data for this can be obtained through commercial section officers working in partner countries);
- Address is suspect: country or region is high-risk, the address is in a free zone, the business is not licensed for a free zone, the address is incomplete;
- Shipper is a bank, non-vessel operating common carrier or freight forwarder;
- Shipper has never exported this commodity (unusual HS code-exporter combination)

General factors that can be taken into account when building risk profiles include the following:

Domain knowledge or familiarity

- Transaction history of entities, frequency and volume of transactions – e.g. first-time, recently established, low volume, very high volume, etc.
- Identity confirmation: unique number, business registration profile
- Accredited or known client category, such as authorized economic operator systems

Intelligence

- Strategic information: e.g. country of origin, country of export
- Tactical information: person, container, product description

Geographical / locational parameters

- Origin location
- Transit location
- Destination location
- Routing information, e.g. ports of call, transhipment history

History of non-compliance

- Accurate or probable matches to internal prior violation history, subject of investigation and other law enforcement records
- Ranked based on severity

Risk indicators should be specific and defined. If they are too broad, they will result in false positives (identified for targeting without having committed any violation) or false negatives (failure to target those who may have committed violations). Good data are also essential to avoid false results.

Risk register

A risk register is an organizational planning document identifying compliance risks and allocating identified risks to risk owners. It supports a risk-based approach by covering financial and other risks related to security, safety, intellectual property rights, environment, etc. A risk register is based on an assessment of risks at regional level along with potential strategic threats. Risks should be ordered according to the assumed hierarchy of threats (high, medium, low) assigned to risk areas. It enables risk owners to manage organizational and operational risks in a more structured manner.[97]

Risk registers should include information about identified (confirmed) risks and show risk owners. They enable structured management of risks, show identified or potential risk areas, and set priorities to address risks. Risk registers should be updated regularly and verified periodically, on a quarterly or semi-annual basis, for instance.

Developing compliance rules and risk profiles to target customs risks

Sources of information for risk management

A risk-based approach relies on the collection, evaluation and analysis of different types of information from different sources. Information supports decision-making at the different levels of a customs risk management (CRM) approach – information is evaluated at strategic, tactical and operational levels.

Table 26 Evaluating information on different levels

Management level	Time period	Frequency	Source	Certanty	Area	Scope
Strategic	Long term	Low	Mostly external	Less certain	Broad	Summarized
Tactical	Midterm	Medium ad hoc	Internal or external	Medium certainty	Specific	Detailed
Operational	Short term	High	Mostly internal	More certain	Specific	Detailed

Source: Rafal Pryk, elaborated for this guide.

The WCO Risk Management Compendium lists the sources of data available to a customs administration. These include seizure reports; strategic, tactical and operational reports of other customs administrations; intelligence data; information exchange with other customs administrations; risk signals from customs officers and other law enforcement personnel; cooperation or interviews with other knowledgeable people from the import and transportation trade (customs brokers, cargo agents, warehouse personnel, etc.); transport documents such as manifests and airway bills; national customs (or other law enforcement agencies') databases; signals and alerts.

There are two types of information: external and internal. The information sources used in CRM can also be categorized as primary and secondary. Primary sources include interviews, reports and other first-hand information. Secondary sources are public information, whether it comes from the organization or externally, gathered from:

- Internal searches of databases, text documents, reports, visual objects such as maps and graphs, e-mail and intranet discussions;
- External searches of web-based sources such as web pages, messaging services and databases;

- Comprehensive, adaptable word-based searches, phrases, concepts, dates and other search capabilities;
- Web indexing using a 'spider' application based on predefined queries by the user.

Sources of risk management at border crossing points for goods clearance include:

- Intelligence products created at local and regional customs intelligence offices and strategic intelligence products created at the central customs headquarters;
- Information sharing with other government and law enforcement agencies;
- Information and feedback based on customs controls, in the form of seizure reports;
- Cooperation with stakeholders (airlines, shipping lines, agents, airport/port operators, competitors);
- Other customs administrations and international sources;
- Open-source information (internet, Really Simple Syndication, etc.) or social media (Facebook, Twitter, etc.);
- Tax collection agencies;
- Informants.

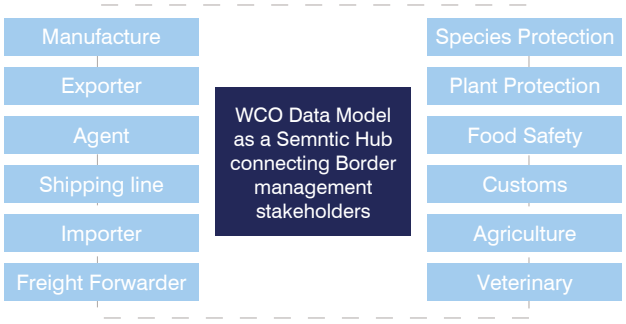
Despite a growing trend towards automation and use of IT systems in risk management, customs officers play a key role. Customs intelligence officers, risk analysis experts, the operational staff at borders and informants are valuable information sources for risk management and are needed to understand and give meaning to data and documents. Customs administrations can use open sources of information such as message services, newsgroups and other external forums.[98]

WCO data model

The WCO data model is an important instrument that helps ensure effective gathering and storage of data required, *inter alia*, to target risk. This data model is a compilation of clearly structured, harmonized, standardized and reusable sets of data definitions and electronic messages designed to meet operational and legal requirements of cross-border regulatory agencies, including customs, which is responsible for border management.[99]

Importantly, standardized datasets and electronic messages that include data beyond the focus of customs allows customs administrations, cross-border regulatory agencies and the private sector to benefit from use of the WCO data model:

Figure 32 WCO data model



Source: WCO, 2019.

The model allows a regulatory authority to build a history dataset according to factors relevant for each risk that needs to be targeted.

Risk indicators may be developed from data provided by an intelligence source, such as investigation reports or bulletins from law-enforcement agencies. Analysis of quantitative open sources, such as internationally reported trade, crime and seizures, can also be used an input to this process.

Data can be collected from sources including:

- Seizure reports
- Intelligence data
- Cooperation with and intelligence from other law enforcement agencies
- Information from trade and industry, carriers, brokers, etc.
- Irregularities detected in transactions and audits
- Trade documents such as invoices, lists of ship cargo and transport documents
- Public information

Data come in various formats and standards. To make them usable, they must be properly tabulated, converted into a database and tested to ensure uniformity (e.g. date formats, values with currencies, units of measurements). The following steps should be taken to achieve this:

- Verify reliability and accuracy of data
- Select chart formats that allow comparison of pertinent data
- Itemize data elements in the chart
- Convert into a computer database, if feasible

Deriving risk factors from the available data

Sources and types of data should be used to develop a set of risk factors using the reference model of a targeting framework and approaches described in Chapter 4. The database containing risk factors is often referred to as a derived database, as it contains parameters derived from transactional data. It can contain aggregated values such as averages and ranges (minimum and maximum deviations) that can be used to configure selectivity filters and to apply compliance rules.

In the context of customs risks, these parameters may include traders' categories according to their regularity or frequency, performance indicator averages, thresholds, product classifiers based on non-compliance incidences and trade trends (growth rate, or projected volume of trade). Compliance rules and selectivity filters should be validated, applied and updated according to the reference model described in Chapter 4.

WCO BACUDA project: supporting customs with data analytics

The Band of Customs Data Analysts (BACUDA) is a research project between customs and data scientists seeking to develop data analytics methodologies, including algorithms in open-source programming languages (R or Python). To develop the algorithms, BACUDA analysts use customs data at the most disaggregated level, i.e. the transaction level. Such data are collected from customs administrations that support the project and then anonymized to respect confidentiality.

The potential success of the project lies with access to a huge amount of data at the transaction level. However, BACUDA experts also work with open-source data, which are not limited to macroeconomic or geographical and spatial data sourced from international organizations. This also includes satellite images in the public domain published by some spatial and military agencies.

Experts also use some platforms to track means of conveyance, such as airplanes, as well as criminal activity or specific events.[96] Together, these data provide a better understanding of border-related activities and supply chains.

Thanks to text mining and web scraping tools, unstructured data can be extracted from web pages or social networking sites, and then analysed. For example, price data on online shopping platforms can be cross-referenced to assess the conformity of the declared value of an item for customs valuation purposes.

Box 2 Tips for preparing data

- Always retain the original copies of data received from anywhere, i.e. 'save as' another copy for cleansing, manipulation and further steps;
- Check duplicate records;
- Check format consistency, especially dates, currency and unit of measurement;
- Check boundary values, such as maximum and minimum values appearing in numerical columns;
- Check 'null' values in columns where they are not expected to be null;
- Take summary values, aggregate count of transactions or entities, or sum value, and see if it makes intuitive sense.

The project team has already developed basic methods and algorithms categorized by the following objectives: Mirror Data Analysis with R and Shiny, Forecasting Customs Revenue, Revenue Gap Analysis, Web Scraping of Price Data, and Customs Fraud Detection by Machine Learning with Random Forest and Python.[100]

Risk management at border crossing points

Border crossing points are the official points of entry into and exit from a country and national customs territory. Goods are placed under customs control and must comply with national regulations including customs law and traffic regulations.

The customs clearance procedure itself, however, does not necessarily take place at the border crossing point. For instance, under a customs transit regime, goods provisionally exempted from duties, taxes and commercial policy measures applicable to imports move between two points in a customs territory, via a different customs territory, or between two or more different customs territories. The regime reduces the risk of congestion at external borders, sea ports, airports and land borders by shifting controls inland, at departure and destination, closer to the traders' premises.[101]

Thus, different control procedures apply at borders, and the risk management approach and practices also differ. The differences in risk management at border crossings and risk management as part of the customs clearance procedure lie with the nature of risks and sources of information used for targeting. In addition, targeting is usually not automated.

The control of financial (commercial) risks is less important at borders than the control of risks related to public health, environmental protection, national security and the fight against terrorism. Security is the main border threat and has grown in importance in past years due to the focus on fighting terrorism. Smuggling of weapons and prohibited goods that can be used for attacks should be prevented at border crossings.

Customs authorities and other government agencies also enforce regulatory objectives – protection of human, plant and animal life and the environment – at border entry points to prevent harmful substances, pests and diseases from entering the territory. Because of this different environment and nature of risks, customs officers at border crossing points must rely on different information sources to manage risk. The targeting at border crossing points uses local profiles, intuition, intelligence and other information sources from third parties, such as military, immigration and forwarding agents, as explained above.

Entry procedures at borders frequently cause long waiting times and delays as traffic volumes are growing and the infrastructure and design of border stations are often not adapted to border control operations. Effective control of goods, passengers and means of transports is therefore complex and difficult. A specific risk management approach at borders enables customs authorities to improve performance and to facilitate border crossing, including through simplification measures such as fast lanes. Integrated border management and common IT systems are essential to underpin risk management at borders.[102]

Risk management related to transport

Modes of transport describe the different types of transportation used in international trade: maritime, air and road. Each mode has specific characteristics relevant for customs control and CRM. Therefore, a customs administration needs to adopt dedicated control strategies for each mode, taking into account the specificities of each mode of transport.

Air transportation

The specificities of air transportation allow an efficient application of risk management. There are few operators and they are normally subject to strict government controls requiring professional operations and respect of international rules including security.

In addition, entry points of air cargo are limited to airport facilities, which are tightly regulated (scrutiny and authorization of staff, adoption of quality and security protocols) and managed following international and national norms. Furthermore, information on goods and people is available by the carrier in electronic format and the submission of pre-arrival information is now mandatory in many countries. Finally, the journey follows the most direct route, limiting opportunities of access to the cargo for non-authorized people so that air cargo operators and the carriers can effectively control cargo.

The most valuable document related to air cargo transportation is the air waybill. The air waybill consists of the unique identification number, shippers and consignees' names and addresses, the airport of departure and

destination, the declared value and information related to the transported goods (content, weight, quantity). On the basis of the air waybill, which is transmitted to customs authorities in advance, the authorities can start the risk analysis process to target shipments for inspection upon arrival.

Land transportation

Land transportation as a specific mode of transport can be conducted through rail transportation and road transportation.

Rail transportation: Rail stations are railroad systems with at least one switch, providing a starting and ending point for trains and allowing them to swerve or turn. Rail transport has a shortage of variants and flexibility because rail cars must move along the railroad. As a result, they move from terminal to terminal, and not from point to point unless the companies have a railroad in their premises.

The infrastructure of rail transport is composed of rail stations (properties, buildings and other facilities to transport cargo and passengers by rail) and railroad systems. At border crossing points and specific inland stations as a part of rail station infrastructure, there is customs authority authorized to control passengers and cargo transported by the rail.

Road transportation: Road transportation involves cars and buses for passengers and trucks for goods. Trucks can transport goods for moderate costs that can vary based on the sensitivity of goods transported, fluctuations of fuel costs and road conditions.

In most cases, the risk assessment for road transportation involving to trucks, cars, buses or foot passengers can be carried out through their identity information (vehicle and passenger information) with the help of an automated system (intelligence, suspect list, alert systems) at border crossing points. Also, the knowledge and experience of customs officers at the border crossing points is of utmost importance to identify suspicious or anomalous behaviour by passengers and carry out further examination.

Sea transportation

Sea transport remains the main mode of transport in international trade. Maritime shipping is generally used for large shipments with lower commercial value and a longer delivery timeframe. The transport document used in the sea transport is the bill of lading, which has important information that can be used for risk assessment before the ship actually arrives.

Table 27 Modes of transport and elements of customs risk management

Mode of Transport				
Processes	Air	Rail	Road	Sea
Cargo pre-arrival information	Easy	Easy	Easy	Easy
Passenger pre-arrival information	Easy	Difficult	Difficult	Difficult
Speed	Fast	Slow	Moderate	Slow
Costs	High	Moderate	Moderate	Low
Cargo selectivity/targeting	Easy	Easy	Easy	Easy
Passenger selectivity/targeting	Easy	Difficult	Difficult	Difficult
Tracking and tracing of shipments	Yes	No	No	Yes

Source: Rafal Pryk, elaborated for this guide

Maritime transport is the slowest, yet most cost-effective, mode of transportation for large quantities of goods. The advent of containerization has led to the standardization of many business processes involved in the logistics management of these vessels. Customs administrations can leverage these two facts to easily acquire data well in advance of arrival, which provides an excellent opportunity for quality risk assessment to be performed.

The air cargo environment is becoming increasingly popular for global freight transportation. Though more costly than shipping by sea, air transport means shorter shipping times, which is convenient. Business and consumer demand for fast, efficient shipment of goods has fueled the rapid growth of the air cargo industry.

Air cargo is frequently carried on passenger aircraft, making this environment more vulnerable to security threats than other modes. This mix of cargo and passengers on a single conveyance requires that risk assessment be performed on both to clear the same plane.

Rail carriers mainly provide rail cargo reports, which contain much of the same information as maritime cargo reports and can be risk assessed in a similar manner. It can be difficult to assess rail cargo and containers adequately. Few rail offloads can normally be achieved due to logistical constraints, limited resources and available inspection technologies, so risk assessment systems are critical in determining whether to inspect or facilitate.

Sufficient time must be allotted for this risk assessment to occur, which is why many customs administrations recommend adopting a one-hour minimum requirement for transmission of pre-arrival data in the rail mode. However, information on passengers is rarely available.

Inspecting road cargo adequately can also be difficult due to infrastructure constraints at land border crossings. Like other modes, road border operations should seek to acquire pre-arrival data to inform decisions. Road cargo documents are similar to rail and marine documents and, if provided electronically and in advance of arrival, can be used to assess risk on all shipments due to arrive at the border.[103]

Other modes of transportation

Other conveyances can be used to transport specific types of goods:

- **Pipelines** are a mode of transport restricted to commodities that are liquids or gas, such as oil and natural gas.
- **Electronic transport or cable** is the fastest mode of transport, but is limited to special commodities that can be transported electronically, such as electricity, data and products containing electronic data such as music, pictures and text.
- **Unmanned aerial vehicle transport** is still in a testing stage (Amazon.com and other transportation companies). This method uses drone transportation of goods and is used on a regional or national level, but the technological developments are promising. This mode of transport could become a global option for express transport of small quantities of goods and small-parcel delivery.

These modes of transport, especially transport through pipelines and electric transport, are handled by authorized traders who are part of the risk assessment in the authorized process. These transport modes use equipment that can precisely measure the quantity of the transported goods.[104]

Building risk profiles

Risk profiles are rules based on observations of passengers, traders, goods, means of transport, specific information from the international customs community and predictive data analytics. These rules are a logical combination of two or more indicators, ranging from relatively simple to highly complex algorithms.[105]

Traditional selectivity and profiling systems only manage watch lists – that is, lists of suspect entities – by combining selectivity filters. For effective outlier detection, insights from databases and machine learning techniques are used. For a selectivity tool based on information and communication technology (ICT), the system should provide configurability to create user-defined risk rules that allow multiple variables and combinations of risk indicators. More complex rules typically combine several conditions or calculations. Continuously updating existing rules or defining new rules is vital for the effectiveness of risk management.

A risk profile should contain a description of the risk area, an assessment of the risk, the counter-measures to be taken, an action date, the results and an evaluation of the effectiveness of the action taken. The counter-measures included in risk profiles are instructions on how to deal with the particular shipment given the circumstance. Such circumstances can affect the treatment decision for the shipment.[106]

The procedure used to profile a transaction must be based on a standardized and objective methodology to avoid arbitrary decisions basely solely on the whim of an individual, and to avoid possible collusion and corruption. Conversely, given the evolving nature of world trade, risk management practices must be dynamic and scalable. A consistent and well-structured risk management framework provides incentives for economic operators and influences their behaviour.

The procedure underlying the elaboration of risk profiles must not be decodable by economic operators, as they must not be given any opportunity to circumvent the rules. Finally, risk management systems must be implemented using computerized processes, in accordance with the revised Kyoto Convention and the recommendations of international institutions on the modernization of border control practices using standardized, non-intrusive methods.[107]

Analytical approach for developing risk profiles

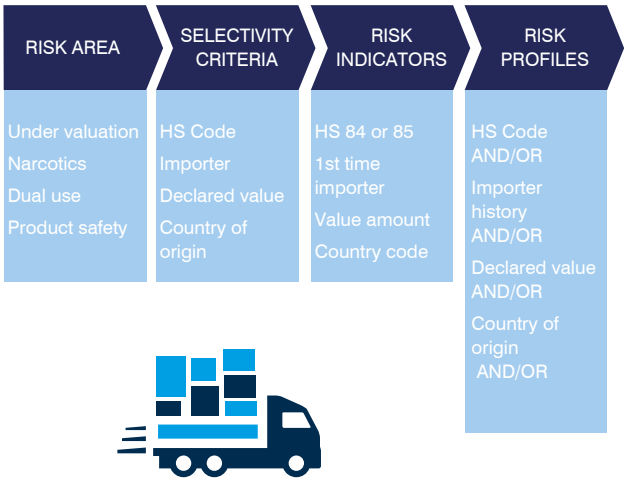
Creating a risk profile requires a comprehensive understanding of all data forms, from intelligence reports to audit findings, to best identify potentially risky combinations. These data are then converted into a profile that includes selection filters. For instance, historical shipment data and corresponding inspection results can be studied to identify risk indicators and evaluate patterns.

The rules for filtering out unusuals or outliers can be developed by human inspection of the data or a computer system model using artificial intelligence, pattern recognition or data-mining techniques.

Example of a risk profile

The risk profile characterizes the risk based on the risk area, selection criteria and risk indicators.

Figure 33 Generation of a risk profile



Source: Adopted from WCO's Risk Management Guide, 2003.

The indicator can be single variable or multivariable, as follows:

- Simple single-variable risk indicators
- HS Code = Chapter 23
- Declared value > $1,000
- Importer has < 3 importers of this item in last 5 months
- Multivariable risk indicators
- Direction: Import or transit
- Last port of call is ABC: AND
- HS is 7203% or 7204%: AND
- Country of origin is not related to declared HS Code

Assigning weights to risk factors

Risk analysts can perform a retrospective comparative analysis of customs data for a specific type of consignment, based on attributes such as weight, country of origin or shipping dates, that assigns risk scores using statistical methods. These basic indicators are entered into the risk management system and used to calculate the score. Using or combining additional indicators can trigger a comparative analysis.

The indicators, combined with the historical non-compliance models, can assist in the creation of risk profiles. The risk management should be able to calculate the value for each indicator in the non-compliance model to a standard numeric score by comparing an individual indicator value against another consignment that is being profiled. The more a consignment suspiciously deviates from its peers, the higher the assigned score.[108]

Risk indicators can be combined to form rules to address a specific threat or mode of transportation. Rules may consist of system-based or user-defined rules, or look-up lists and tables.

Rules are aggregated into multivariate rules to combine different specific risk profiles. Each rule is assigned a quantitative value or 'weight'. The weight-setting score for the transaction or shipment is the sum of the total of the weights for all the rules that trigger the selection of that transaction or shipment.

Table 28 Simplified risk indicator weight-setting example

Rule ID #A	Rule description	Weight
R007	First time importer	100
R044	First time shipper	50
R055	High risk origin list L7	70
R025	Country of intrest list C2	35
R066	Accredited emtrity / AEO member	-75

Data analysis approaches for developing risk profiles

Data analysis helps risk management detect deviations by providing a system foundation based on a combination of indicators, profiling of similar entities (people, means of transport) and commodities combined with analytical tools and data-mining algorithms. By using the risk management system, customs specialists can define peer groups and compliance models for declared consignments and people.

A hierarchy of scores or 'ground for suspicion' is created from the risk profiles, with high-risk consignments flagged for selection and review. Data mining directly drives success, affecting the 'hit rates' of inspections of targeted consignments. Effective targeting, through the ability to produce accurate and timely decisions about potential fraud violations, can help improve regulatory enforcement and resource deployment.

The business intelligence system can help risk management analysts improve case selection and proactively prevent fraud and other regulatory violations. Data analysis tools give these analysts more efficient ways to manage and mine the data to identify importers/exporters that are misdeclaring their consignments.

Risk management gathers a wide variety of structured and unstructured data. The data warehouse and business intelligence are the solution to manage such a complex data layers. Customs administrations must have a clear understanding of what drives their business and technological needs. Examples of structured and unstructured data can include:

- Historical crime incidents: location, crime type, severity, victims, suspects, convictions, criminal behaviours and attributes;
- Enabling factors: place, route, time of year, month or week;
- Trigger events: holidays, weekends or working day;
- Unstructured data: pictures, audio/video and text contained in irregularities reports, e-mail and open sources.

This information is critical to analyse interactions and uncover the attitudes, desires and motivations of entities to predict some illegal behaviours even before offences are committed.

Advanced data analytics, pattern recognition (data mining) and knowledge extraction techniques can also help to identify risks. Predictive analysis techniques, for instance, can evaluate historical cargo and transactional data and outcomes to identify and verify relationships. CRM and intelligence must evaluate past predictions and actions captured. The feedback loop lets the predictive models grow smarter and helps risk management to focus efforts on these areas.

Data mining

Crime prediction and prevention analytics from data mining can assist risk management to make the best use of resources and information and to measure and predict crime and crime trends. Mining of law enforcement data provides insight that lets risk management and intelligence track criminal activities, predict the probability of crime/incidents, effectively deploy resources and solve cases faster.

Data mining can help risk management through the following characteristics:

- Instrumented – Information/enforcement records collected from multiple data sources and analysed for hidden patterns and relationships that are vital to fight violations of law;
- Interconnected – Data warehouse, business intelligence and data mining can provide risk management with quick and reliable access to easily understand analytic crime forecasts based on historical data, intelligence, open sources, etc.;
- Intelligence – Criminal behaviour, patterns and proactive tactical enforcement decisions that are generated in predefined time-frames or on an ad hoc basis, on the dashboard or in risk management reports and analysis will need to extend the domain of the data by using techniques to extract knowledge from text data about something that was previously unknown.

Machine learning

Machine learning is a method used in data mining that consists of algorithms that analyse a set of data to deduce rules constituting new knowledge and assess new situations. This method can analyse vast amounts of data while providing in-depth predictive analysis. It is widely regarded as a technique that can provide this analytical power to model complex, non-linear relationships.

Machine learning includes a range of analytical tools that can be classified as 'supervised' and 'unsupervised' learning tools. Supervised machine learning involves the creation of a statistical model to predict or estimate a result based on one or more inputs (for instance, predicting the non-compliance of a customs declaration registered in the IT system of the partner administration in accordance with several variables or risk factors). In unsupervised learning, a set of data is analysed with no dependent variables to estimate or predict. Instead, data are analysed to show patterns and structures in a dataset.[109]

Decision trees

The decision tree is a non-parametric supervised learning method used for classification purposes and to develop predictive algorithms. The goal of using decision trees is to create a model that predicts the value of a target variable by learning simple decision rules derived from the characteristics of the data.

Decision trees are built by seeking, through the successive fragmentation of the training set, partitions in the space of the optimal predictors capable of predicting the modality of the response variable. Each rupture is done in accordance with the values of a predictor.

All predictors are first tested to identify which are best. The process is then repeated at each new node until a stop criterion is satisfied. The determination of the best rupture at each node is made in accordance with a local criterion. The choice of criterion is the main difference between the different methods of tree induction.[110]

Text mining

Text databases are growing rapidly due to the increasing amount of information available in electronic form. This includes electronic publications, news articles, research papers, books, digital libraries and e-mail. The internet can be used as an interconnected, dynamic text database. The data and information should be stored in the form of structured text databases.

Unlike the field of database systems, focused on query and transaction processing of structured data, text mining is a way to organize and retrieve information from a large number of text-based documents. The goal of text mining is to discover or derive new information from data, finding patterns across datasets, and/or separating signal from noise (or snowflakes).

There are many approaches to text mining, which can be classified from different perspectives. The approaches vary based on the inputs in the text-mining system and the data-mining tasks to be performed. The major approaches to text mining, based on the kinds of data they take as input, are:

- Keyword-based – where the input is a set of keywords or terms in the documents;
- Tagging – where the input is a set of tags;
- Information extraction – which inputs semantic information, such as events, facts or entities that it uncovers.

Predictive analysis

Predictive analysis is very important to CRM, considering the output of predictive and descriptive models. In this information environment, analysis becomes second nature. CRM at any level has ready access to useful information that helps it make decisions grounded in data. Better decisions, based on data prediction, help CRM predict future events, prevent irregularities, delegate and allocate the resources, and provide an accurate and timely response.

Transactional risk analysis

Real-time or transactional risk analysis is a form of risk classification (or filtering) of customs declarations and supportive documents submitted by the trader. The risk classification is performed either solely on the basis of the information in the submitted document or by all available supplementary information about a trader, including information in the customs declarations.

What characterizes such an application is its real-time nature, where the standard risk cycle is stopped pending the output of the risk analysis and the subsequent flow depends on the output. The objective is to classify transactions or events (e.g. the incoming declarations or items in the declaration) into categories (dependent on the type or purpose of the calling system), each requiring a particular action.

The most straightforward example involves classifying objects (means of transport, companies, passengers, declarations, goods, etc.) into two categories – those requiring some form of intervention (e.g. a customs inspection) before the CRM cycle can resume and those that do not require any intervention before the CRM cycle can resume.

The transactional risk module is tightly integrated, or 'plugged into', the processing flow of the corresponding part of the customs declaration processing system. As such, it is triggered (or called) by the production system that needs the risk module to undertake a risk analysis, and the risk module makes its output available back to the calling system in a suitable form.

In the customs context, one of the main reasons to use transactional risk analysis is to screen the risk of goods in the clearance process using pre-arrival information (e.g. manifest) and customs declarations. The transactional risk analysis determines the risk associated with the shipment (either at the level of the whole shipment or on the individual consignment level) and the need for physical intervention.

Behavioural risk analysis

Behavioural risk analysis involves in-depth profiling of the risk entities (e.g. traders, passengers, means of transport) from various risk perspectives, to support a subsequent business process that depends on this risk rating. The analysis is performed on user request – either on an ad hoc basis or according to some predetermined schedule (e.g. when a trader first registers or at a particular time of the year). Behavioural risk analysis is used for different purposes:

- To provide qualifying input into the transactional risk analysis stage. For example, rules in the transactional risk analysis stage often invoke a rating of the trader associated with the transaction being analysed to provide a greater level of precision in the transactional analysis;
- To rate the risk entity on one or more certification programmes (such as an authorized economic operator [AEO] programme, a partnership programme or a key customer programme);
- To identify which risk entities should be subjected to some form of control action, as is the case in post-clearance audits and various types of quality assurance audits.[111]

Evaluating compliance rules and risk profiles

Any ICT-based automated selectivity environment must be tested and calibrated before it is implemented.

Test set and validation set

A profile test can be run on recent historical data, such as that of the previous three-month period, to answer the following questions:

- Is the type of transaction selected in the profile the same as that to be filtered for selectivity?
- Is the total number of expected interventions in a period (e.g. per day) manageable using available resources?

This may require a separate software utility or application to test-run and simulate a profile (or set of profiles) and examine results. This testing process helps show if a profile is likely to give expected results and reveal the right number of entities. A method shared by the US Customs and Border Protection team in a risk management training workshop is given below.

A performance management system is important to optimize an organization's resources. The number of expected interventions and resources required can be estimated through a test-run of risk profiles. This estimate will be based on actual past performance in respective processes (e.g. average time taken for inspections, assessments, sampling). A risk threshold may need to be adjusted (by changing profile weights) based on the availability of resources.

Risk management and performance management systems are linked. Without performance measurement, risk management cannot be effectively used for resource optimization.

'Confusion matrix' – testing profile efficacy example

In the two-class scenario, samples can be categorized into four groups after the classification process is denoted in the confusion matrix. This study adopts the two-class classification for customs risk detection, assuming that the predicted positive declarations are considered to be high risk and inspected, while the predicted negative declarations are considered low risk and released.

Table 29 Confusion matrix of two-class classification for customs risk detection

		Predicted class	
		Predict positive – inspected	Predict negative – released
Actual class	False	False declaration inspected (True positives)	False declaration released (False negatives)
	True	True declaration inspected (False positive)	True declaration released (True negatives)

Source: Rafal Pryk, elaborated for this guide.

There are two types of errors in this two-class classification model: false negative and false positive. False negative refers to false declarations that are wrongly released. False positive refers to true declarations that are unnecessarily inspected. Obviously, the actual losses of different types of misclassification are different.

Take a bank's loan business, for instance. It will incur much higher costs when misjudging an 'actual bad' as an 'actual good' than misjudging an 'actual good' as an 'actual bad'. Similarly, regarding risk detection in customs, the consequences of misjudging a false declaration as legitimate are much more serious than misjudging a true declaration as a fraudulent one. Therefore, customs risk detection could be categorized in the cost-sensitive decision-making process, where different misclassification errors incur different costs.

In view of this, the cost-sensitive classification technique can be introduced to generate a model that has the lowest cost). The classifier can thus cover more positive examples, although at the expense of generating additional false alarms.

Table 30 Cost matrix for customs risk detection

		Predicted class	
		Predict positive – inspected	Predict negative – released
Actual class	False	0	Cost (A)
	True	Cost (B)	0

Note: The cost of committing a false negative error is denoted as Cost (A), and the false positive error is denoted as Cost (B). The cost of correct classifications – true positive and true negative – are both set to be zero.

Source: Rafal Pryk, elaborated for this guide.

According to the previous assumption that all the positive predictions are inspected, higher Cost (A) will lead to a larger proportion of positive predictions, that is, the rate of inspection will increase. This means the cost matrix could be set according to the target inspection rate and the detection rate (successfully seized rate). As a result, the ratio of Cost (A) and Cost (B) in the cost matrix in the table is basically the trade-off between trade security and facilitation.

To detect high-risk commodities such as drugs, the ratio should be markedly higher. In contrast, the ratio could be adjusted under the constraints of limited inspection resources if it is for general risk profiling of regional declarations.[112]

Tax administrations use a confusion matrix to test efficacy of their models as illustrated by the following:

Table 31 Confusion matrix

Predicted actual	Complying	Evading
Complying	True negative	False positive
Evading	False negative	True positive

Source: Rafal Pryk, elaborated for this guide.

The basic terms used in the matrix are described below:

- **True positives (TP):** Cases where the model predicted 'yes' (they have the risk), and they do have the problem (i.e. discrepancy is found).
- **True negatives (TN):** The model predicted 'no', and they do not have the problem.
- **False positives (FP):** The model predicted 'yes', but they don't actually have any discrepancy.
- **False negatives (FN):** The model predicted 'no', but they actually had a discrepancy.

Based on this matrix, one can compute several selection criteria:

- **Accuracy rate:** (TN+TP)/Total – measures the percentage of cases predicted correctly by the model.
- **Prediction efficiency:** TP/(TP+FN) – measures the percentage of non-compliant cases correctly predicted by the model.
- **Strike rate:** TP/(TP+FP) – measures the percentage of non-compliant cases likely to be detected if predicted evading cases are checked for compliance.

Below is an example of a confusion matrix for a binary classifier (yes or no). It represents a prediction result of a total 165 transactions or cases. It predicted yes (risk exists) in 110 cases and no in 55.

On actual inspection or audit, discrepancies were found in 105 cases. The remaining 60 cases, though identified by the risk engine, had no anomaly.

n=165	Predicted NO	Predicted YES
Actual no	50	10
Actual yes	5	100

Using the confusion matrix terms, it may present as follows:

n=165	Predicted NO	Predicted YES	
Actual no	TN = 50	FP = 10	60
Actual yes	FN = 5	TP = 100	105
	55	110	

- Accuracy = (TP+TN)/total = (100+50) / 165 = 0.91 = 91%
- Alternatively, (FP+FN)/total = (10+5)/165 =0.09 = 9% is 'error rate'
- Precision is measured as TP/(predicted yes) = TP/(TP+FP)
- It measures 'when it is predicted yes, how often it is correct?'
- 'Sensitivity' or 'recall' or total positive rate
- It is calculated as TP/actual yes = TP/(TP+FN)
- It measures 'when it is actually yes, how often did it predict yes?

The results of the model – such as value addition (for instance, additional revenue collected or value of goods confiscated) as a result of interventions, and the effectiveness of individual rules – should be analysed to show if there are ineffective profiles or risk rules, which can be revised or removed, or the statistical model can be re-calibrated.

Updating risk profiles

Based on an effectiveness analysis, a profile may be modified or deactivated. The approval process for updating risk management profiles should be defined and respected. Any major review of profiles should be presented to the risk management committee.

Risk profiles need to be reviewed continuously due to identification of new risks and changes in legislation, procedures and processes. Outdated or irrelevant profiles, if not disabled, may result in over-hitting (false positives) or under-hitting (false negatives) and lead to failure to achieve the purpose of selectivity. Profiles should be reviewed by measuring the results of interventions to assess efficiency of the risk-profiling system.[113]

Applying compliance rules: Activating risk profiles

After running simulations and fine-tuning the rules for selectivity, a risk profile system can be activated and may be executed through any available communication channels, such as alert bulletins, briefing sessions, telephone and e-mail.

Pre-arrival and pre-departure information

Another global trend is the pre-arrival and pre-departure exchange of information that requires electronic submission of the declaration data and other information to customs administration before goods arrive or depart. The benefits for customs administrations are the following:

- Acceleration of customs procedures and facilitation of legitimate trade;
- Prevention of undervaluation – revenue collection;
- Promote/improve cross-border communication and cooperation;
- Automated data matching – less documentary and physical control;
- Pre-arrival risk assessment – pre-arrival clearance.

Pre-arrival exchange of information also supports risk management. Customs administrations increasingly require operators to submit declaration data and other information before goods arrive or depart. In such a way, risk management can be used to its full potential.[114]

Box 3 US case study: Timeline requirements for incoming cargo

- Vessel: 24 hours before loading
- Air: Four hours before arrival or wheels-up from the following locations:
  - Canada, Mexico, Caribbean, Central America, South America (above the Equator)
- Rail: Two hours before arrival
- Truck: One hour (30 minutes for the Free and Secure Trade programme)

Note: The Free and Secure Trade programme is a commercial clearance programme for known low-risk shipments entering the United States from Canada and Mexico. Initiated after 9/11, this innovative trusted traveller/trusted shipper programme allows expedited processing for commercial carriers that have completed background checks and fulfil certain eligibility requirements.

Manifest data elements required for selectivity

Regulatory agencies may require the following data elements for their analysis (they may vary by mode of transportation):

- Bill number
- Conveyance details: Carrier code, arrival data, route (last ports of call)
- Shipper details: Name and address
- Consignee details: Name and address
- Commodity description: many border agencies systems now mandate six-digit HS codes to be declared as part of manifest details
- Piece count
- Weight
- Container details: type, size, ISO code
- Dangerous goods category
- Strategic trade items declaration

The International Convention for the Safety of Life at Sea, an international maritime treaty, now mandates container weights. Requirements for some countries or regions may vary – for example US Customs and Border Control has 10+2 requirements for importer security filing and additional carrier requirements (commonly known as 10+2). This rule applies to import cargo arriving in the United States by vessel.

Limitations due to textual or unstructured information

Administrations face certain common problems in cargo selectivity. Product codes may not be available in the manifest information, or only available as six-digit HS codes. Product descriptions are also often vague and require clarification or modification before they can be used for analysis.

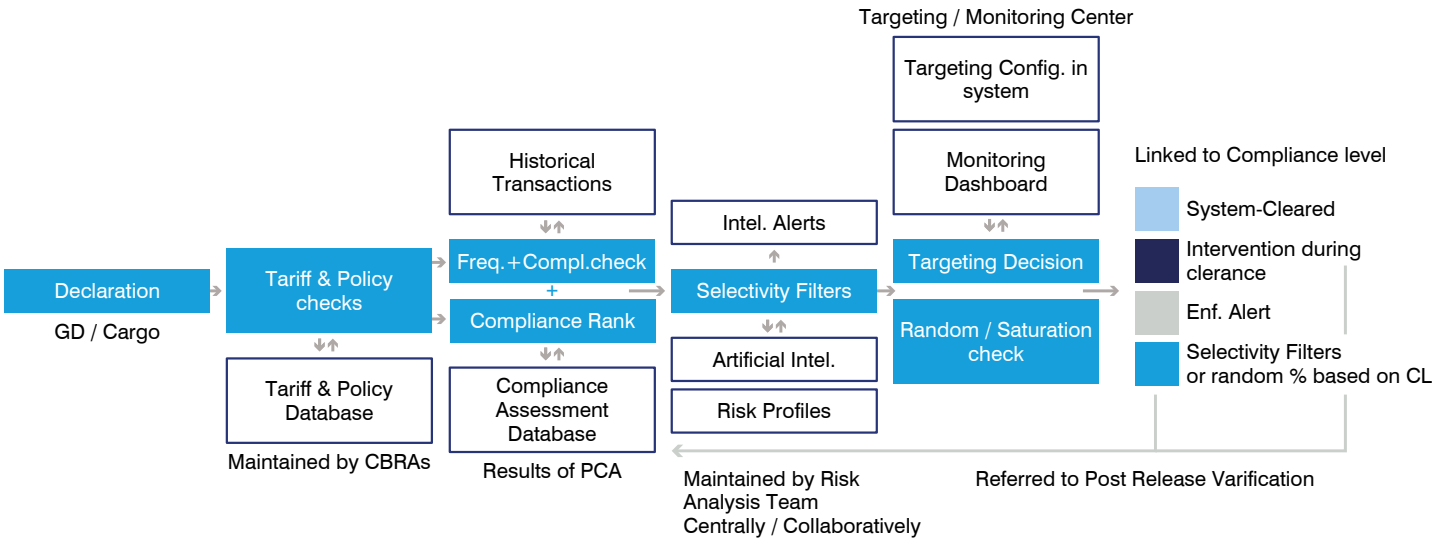
A second problem is that names of entities (consignee or shipper) may not be relevant, and bank or notified party names may appear instead of the actual consignee. Even if names of consignees are given in the cargo manifest, they may be in text form that traditional IT systems cannot identify correctly from the registered traders' database.

These problems can be solved through analysis techniques for unstructured or semi-structured data.

Evaluating incoming shipments

An important part of risk management is preventive and does not only involve selectivity and targeting. A process flow for international trade transactions and interactions with an ICT-based risk management system needs to be defined.

Figure 34 Risk management in border transaction processing



Source: Irfan Sarfraz, elaborated for this guide.

Processes should have risk management principles embedded in each step so they pre-empt errors and non-compliance by detecting anomalous inputs at early stages. This can be done in several ways:

Declaration filing

To prevent errors, checks and validations are built into declaration filing. A mature system will send declarants wrong entry alerts and will have support utilities to help them enter correct inputs, e.g. tariff search, classification search.

Tariff and policy checks

Tariff exemption claims, quota claims and free trade agreement claims are validated according to business rules. In advanced systems, all tariffs, exemptions and concessions, as well as import and export policies, are translated into validation rules. Many errors or inadmissible claims can be filtered out or pre-empted at this stage if tariff and policy tools (ICT-based system) are set up properly.

Compliance-level checks

Using the risk management database, which provides a classification such as risk ranking or category, the system validates the history of entities involved. In situations where the post-clearance audit is not yet mature or has not been integrated into the risk management process, the system must rely solely on trade transactions made by the declarant and agent, or other operators involved.

If the audit shares the compliance level of entities with a transaction processing system, the risk management system is assumed to have a historical profile of each economic operator involved in a transaction (consigner, consignee, carrier, third parties).[115] The aggregate risk associated with all such entities or operators involved in the value chain should be factored in to make the system more intelligent and effective. In other words, instead of relying on one party (importer or exporter), as less-mature risk management systems often do, the compliance level of all supply-chain actors involved in the transaction should be aggregated to arrive at a targeting decision.

Selectivity filters

These are rules and risk management profiles embedded in the system through the risk management process. Either or both of the following elements can trigger detection of non-compliance or unusual or risky transactions:

- Process and rules defined by humans (domain experts) into system
- Artificial intelligence and data-mining techniques are used to discover outliers and unusual patterns

Advanced techniques used for knowledge discovery and patterns are discussed in the data and analytics section.

Targeting decision

After system selectivity, the targeting centre monitoring team decides whether to intervene in the identified transactions.

The role and discretion of personnel varies according to organizational culture. In mature systems, staff may have discretion to override system selectivity, and may turn a 'red channel' transaction into green channel, after looking into the details. This prevents organizational resources from reacting to false positive alerts.

In other cultures, staff may not be allowed to override transactions identified by the system. For example, in Malaysia and Pakistan, officers are not given discretion to make any judgement on system-identified red channel entries.

Random checks and saturation checks

These processes provide additional layers to identify false negatives and patterns not otherwise discovered through risk identification or analysis processes. Transactions selected through this process are stopped for compliance checks.

Performing a risk-based inspection by customs authorities

Tools and techniques used for compliance risk management in an international trade system include audits, enforcement operations, compliance checks at borders, document examination, physical inspection, scanning of cargo, tracking of movements, selectivity and profiling systems.

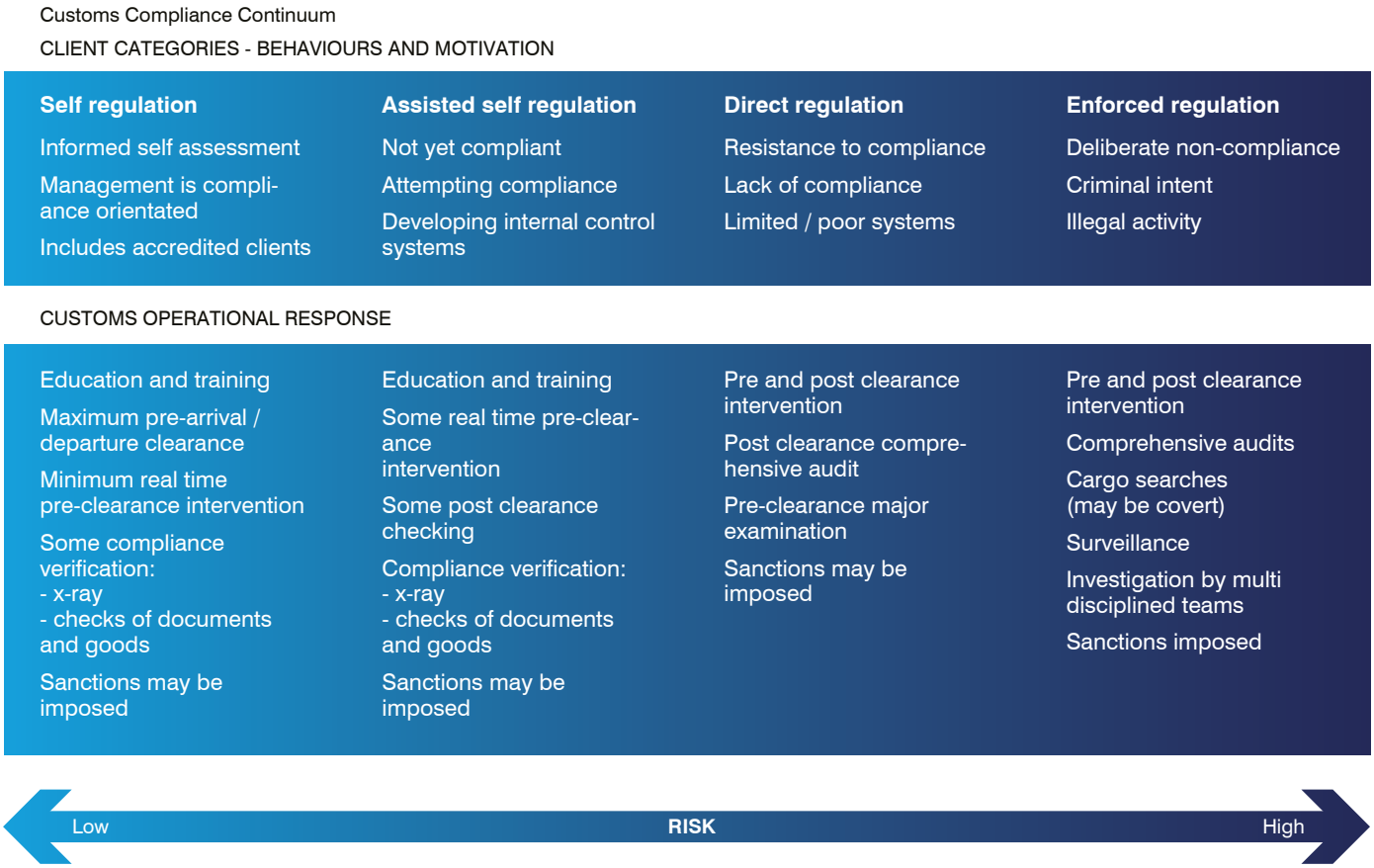
If a risk management system is fine-tuned to segment its clients appropriately, workloads at various stages (pre-arrival / departure, during clearance process and after release) can be distributed to the relevant teams. Through this approach, a risk management system can both reduce the cost of compliance and regulatory burden for legitimate and compliant trade and optimize resources for better compliance management.

The concept of a compliance continuum recognizes that some members of the regulated community will always seek to comply, while others have no intention to do so. These two 'compliance behaviours' sit at opposite ends of the compliance continuum. Those who willingly comply represent the lowest risk, and those who are deliberately non-compliant represent the highest risk.

The appropriate regulatory response depends on where the regulated entity sits on the continuum, and will range from the highest level of penalty to the highest status of AEO. Most members of the international trading community will fall between these two extremes, and the more compliant they become, the less punitive the regulatory response will be.[116]

One example to demonstrate the many different stages of compliance, and where regulations and enforcement become necessary, is shown in the Australian Customs' Compliance document below.[117]

Figure 35 Compliance continuum (Australian Customs)



Source: Australian Customs.

The Australian model, which also maps compliance behaviour against regulatory responses, goes further by identifying the types of regulatory interventions that are considered appropriate to address certain types of compliance behaviours.

For example, at the low-risk end of the continuum, the administration adopts a 'self-regulation' approach, using a monitoring programme to oversee compliance behaviour. The other extreme is where an 'enforced regulation' approach is adopted, which involves investigation and prosecution. For those traders who are seeking to comply but not yet compliant, a strategy of 'assisted self-regulation' is employed, which includes a range of support services including education and advice.[118]

The goal is to ensure there is control of the risk management process of cross-border transactions from pre-arrival to post-release. As a general principle, the physical control of agencies should be focused only on those goods that belong to entities that are not auditable, or goods or entities will later not be trackable. An integrated risk management system envisages a change of role from a gate-keeper (e.g. physical controls at port) to pre- and post-release controls. Post-release controls are audit-based.

Operators' financial and inventory records are audited based on risk. Many operators (especially small and medium-sized businesses) may not be maintaining records of inventory and financial transactions according to general accounting principles and practices and audit-based controls will not work in these instances. For example,

certain fraudulent or fly-by-night operators appear for a period, conduct transactions and then vanish.

For others, who maintain auditable records according to general accounting and auditing practices, audit-based controls are the preferred approach.

Targeting decision, timing and action largely depend on the entity's level of compliance. This approach facilitates legitimate and compliant trade.

Urgency or response time for compliance checks

Timing for compliance check interventions depends on the profile of the economic operators involved in the transactions. A transaction may generate a high-risk score based on product or geographical indicators, but if the declarant is auditable[119] and has a first-rate compliance ranking, the transaction may not be interfered with while the cargo is at the port or border. Although it might be released, it may be triggered for inspection at the premises of the business concerned or through post-release verifications.

Control levels are thus spread out, starting with pre-arrival declaration or manifest filing and continuing until after release through audits and verifications.

Reviewing risk profiles

Changes in legislation, procedures, processes, data codes and versions mean risk rules must be constantly reviewed. Outdated or irrelevant profiles, if not disabled, may result in over-hitting (false positives) or under-hitting (false negatives) and defeat the purpose of selectivity.

Risk profiling therefore needs to be reviewed regularly. Each profile should have a sunset (or end-date) provision, set at the outset of activating the profile, that triggers a process for review.

Profile review should also be done by measuring the results of interventions against actual findings to see how effective the system is. This should culminate in a continuous process to optimize interventions with available resources (such as inspections or documentary examinations).

This is a critical learning loop for the system to mature and stay relevant. Feedback can come in various forms, such as seizure and other analytical and written reports, intelligence and oral reports, and briefing sessions.

ICT technology systems for shipment targeting

System overview and data linkages

A typical cargo targeting system, designed for the purposes of risk management, provides support through the following functionalities:

- Risk assessment functionality;
- Making ad hoc queries and monitoring transactions;
- Receiving and analysing data from other streams of transaction processing, audit records and enforcement (seizures and detention records);
- Receiving data from external systems, e.g. carriers/transporters arrival and departure notices;
- The results of interventions (examination or assessment) initiated through the selectivity criteria must be feeding back into the risk management database. This helps in 'system learning' and classifying next transactions based on similarity of transactions where an anomaly was actually found or otherwise.

Queries, searches and drill-down functionality

A targeting system allows users to retrieve data and relevant information, while an advanced search feature allows users to select filtering criteria. An analyst or monitoring officer can use this to search and retrieve shipments, trade entities, rules (or risk profiles) and weight sets.

This system enables the monitoring officer to see what risk profiles (or selectivity rules) have triggered the shipment for selection and should also allow the user to generate summary reports, e.g. a quick summary of records filtered during a search. It may be linked to related drill-down screens, including the importer's history and profile, the commodity history and the risk profile.

ASYCUDA++

ASYCUDA++ relies on a decentralized architecture, operational on the local level. Many countries are using different tools to migrate the data from the local level to a 'central server' that is used for reporting and analysis services. The risk profiles must be inserted on each of ASY++ local servers manually.

The selectivity criteria on ASYCUDA++ are inserted through IFTTT commands (ASY Structure Query Language-SQL). One risk profile can have more risk indicators, such as country of origin, tariff code, company, registration plate number, etc. To ensure adequate risk analysis efficiency, the criteria set in ASY++ must provide one selectivity criterion for each risk indicator and mathematical and logical operators cannot be used to combine two or more risk indicators in one selectivity criteria.[120]

ASYCUDA WORLD

ASYCUDA WORLD is a web-based customs declaration processing system relying on a centralized IT architecture. The insertion of risk profile selectivity criteria and indicators is centralized and complex mathematical and logical operators (AND, OR, XOR, NOT, LIKE, etc.) can be used.

When the customs declaration matches three risk profiles, ASYCUDA WORLD channels the declaration to the strongest profile. ASYCUDA WORLD does not provide the results from the selectivity criteria (neither risk profile nor risk indicators). The selectivity (in IT terminology, transactional) risk module is embedded, or 'plugged into' the processing flow of the corresponding module of the customs declaration processing system (e.g. import, export).

When an event triggers the risk module to perform the targeting, the risk module sends its available output back to the calling event in a suitable form. Systemic limitations cause 34 OIC MS to use only the selectivity as a risk management method. In its latest version, ASYCUDA WORLD allows results from the control based on selectivity to be entered, limited to one dropdown list (with five irregularities) and free text as a 'control act.'[121]

Measures to mitigate the effects of COVID-19

The COVID-19 pandemic has shown the importance of both the revised Kyoto Convention and the Trade Facilitation Agreement, including major concepts supported by these instruments: an all-digital clearance process and efficient risk management.

Implementing modern, risk-based customs processes that balance the need for compliance with trade facilitation will help to ensure that essential goods reach their destination on time and compliance is maintained. Managing the clearance process remotely and digitally helps protect the health of customs officers and importers/exporters.

Encouraging the adoption of risk management systems and pre-arrival/departure procedures helps expedite the release of low-risk shipments upon arrival/departure and minimize personal contact, protecting both customs officers and importers/exporters.[122]

While some measures will be implemented only temporarily during the pandemic, many should become part of everyday operations, and risk management should be a tool in every customs administration's armory. Both risk management systems and risk profiling are key enablers to facilitate trade and ensure compliance. They also help administrations optimize the use of finite customs resources.

It is critical to continue facilitating the cross-border movement of not only relief goods, but goods in general, to help minimize the impact of the COVID-19 pandemic on economies and societies. Customs administrations were strongly urged to establish a coordinated and proactive approach with all concerned agencies to ensure the integrity and continued facilitation of the global supply chain.

Measures aimed at mitigating the effects of the crisis can be grouped into four categories.[123]

Improving cross-border movement of essential supplies

In the event of a natural disaster and similar catastrophes, as well as sustained emergencies such as famine or disease, aid to those affected obviously needs to be delivered and moved across international boundaries efficiently and expeditiously. The effectiveness of humanitarian assistance relies to a large degree on the speed with which it can be furnished. Customs administrations must therefore be as facilitative as possible and prepared to rapidly clear supplies that, due catastrophic events, are being forwarded as aid.

Most relief consignments are highly regulated items such as foodstuffs, medication, medical equipment, vehicles and telecommunication equipment. In the clearance process, customs often enforces legislation on behalf of other government agencies. This means proper dialogue and coordination with these agencies is paramount, in both the disaster preparedness and response phases, to simplify and facilitate the clearance process. Inspections by other government agencies and inspections by customs should be coordinated and, if possible, carried out at the same time.

Coordination with neighbouring countries is also essential, especially when it comes to measures that restrict the movement of people and goods.

Simplifying and streamlining procedures is equally important to expedite the cross-border movement of relief consignments. Granting import duty waivers is recommended in the international legal framework, but it will not have the desired effect if a cumbersome procedure needs to be followed to obtain the duty waiver.

Below is a list of measures that customs can adopt to facilitate the cross-border movement of relief and essential supplies:

- Coordinate and cooperate with other government agencies with the objective of speeding up the clearance of relief goods;
- Prioritize the clearance of relief consignments on the basis of a list of essential items;
- Clear relief consignments as a matter of priority;
- Provide for the lodging of a simplified goods declaration or of a provisional or incomplete goods declaration;
- Provide for pre-arrival processing of the goods declaration and release of the goods upon arrival;
- Apply risk management and perform inspections on relief goods only if deemed high-risk. Ensure inspections by other government agencies and by customs are coordinated and, if possible, carried out at the same time;
- Advocate for or support the waiving or suspension of import duties and taxes for relief items.[124]

Supporting the economy and supply chain continuity

COVID-19 affected borders, land transport, civil aviation, maritime shipping and business. Government measures such as closures of borders and non-essential businesses, travel bans, export restrictions, social distancing and lockdowns had an immediate effect. Many firms were closed, and more were and remain not fully functional as a result of disrupted supply chains, staffing constraints and sanitary restrictions.

This affected everything from operations to financial capabilities and, ultimately, the potential for a speedy recovery of global trade.

Below are measures that customs can adopt to support the economy and sustain supply chain continuity:

- Set up crisis teams to ensure the performance of customs tasks. Take measures to guarantee personnel availability in the long term. Operate a 24/7 customs clearance system;
- Create a helpdesk to resolve issues faced by importers/exporters;
- Advocate for sustaining end-to-end supply chain continuity, including the smooth and unhampered movement of goods inland;
- Apply risk management to keep physical inspections to the minimum necessary and to speed up customs clearance. Optimize use of non-intrusive inspection equipment;
- Designate priority lanes for freight transport and introduce measures to guarantee supply chain continuity;
- Facilitate the continuation of transport by road, including for goods in transit, when the driver of the means of transport has COVID-19 symptoms;
- Remove restrictions on containers;

- Introduce tax relief measures, such as extending payment of duties, payment of duties in installments and duty drawback;
- Allow for flexibility in extending AEO certifications during the pandemic, while maintaining a suitable monitoring mechanism;
- Waive penalties for delays that are due to late arrival of commercial documents from exporting countries;
- Introduce facilitative measures with regard to the requirements to submit original documents or to stamp certain documents;
- Provide more and better facilities to ATA carnet holders when the temporarily imported goods cannot be re-exported due to a state of emergency.[125]

Protecting staff

The safety of customs and other border agencies staff, as well as people in the private sector involved in the movement and clearance of goods, is critical and should be a high priority. All parties should follow the health safety guidelines issued by each country. In addition, staff should have access to personal protection equipment to ensure their safety.

Below is a list of measures that customs agencies can adopt to protect their staff:

- Provide personal protection equipment to staff, such as masks, gloves and sanitizers;
- Establish an emergency hotline for staff inquiries on preventive measures and reporting of COVID-19 symptoms;
- Apply social distancing measures;
- Enable teleworking when and where feasible;
- Encourage the use of electronic services in conducting business with customs;
- Limit physical inspection to only those shipments identified through risk assessment as high-risk.[126]

Protecting society

Customs agencies play a key role in protecting society by securing transport chains, ensuring product safety and fighting cross-border crime. Customs prevents threats to citizens' health, safety and the environment, and combats the smuggling of narcotics and other dangerous substances, as well as tax and duty evasion.

At the level of borders, many WCO members play an important role in national response strategies to mitigate epidemic-related public health and safety risks. Customs administrations are often a country's first and last lines of defence, and customs officers are among the first government authorities to meet travellers and crew members on board arriving vessels, aircraft and other types of transport. In this context, it is very important that customs administrations with health and safety responsibilities are adequately integrated as part of the preparedness and pre-response mechanisms.

Below is a list of measures that customs can adopt to protect society:

- Ensure appropriate integration in the preparedness and response mechanisms of customs administrations with health and safety responsibilities;
- Share advance passenger information with sanitary control authorities;
- Measure certain indicators and provide statistical data to the government to inform decisions in the response to COVID-19;
- Make pandemic-related information available on official websites and social media accounts;
- Intercept trafficking of counterfeited medical supplies;
- Expand the tax-free use of undenatured alcohol used to produce disinfectant. Donate seized alcohol for the production of disinfectants.[127]

Chapter 6

Addressing product non-compliance risks

Addressing product non-compliance risks

Regulatory authorities responsible for ensuring that imported products comply with technical regulations and standards perform a remarkable share of border control. Planning these controls, which are often carried out by customs on behalf of responsible regulatory authorities, is challenging. Technical regulations contain many requirements that cover families of different products, so inspecting goods in many cases requires costly laboratory testing.

This chapter shows how the reference model of a targeting system described in Chapter 4 can be applied to risks of product non-compliance. Building such systems means import control can be prioritized based on product non-compliance risks and is a prerequisite for developing an integrated risk management system at the border. The chapter describes international best practice in managing product non-compliance risk in various fields and shows how this experience can be used to build a targeting system.

Challenges of product non-compliance inspections

Differences between risks of non-compliance with customs regulations and risks of non-compliance with other regulations, including technical requirements for goods, explain the main challenges that product regulators face at borders. These challenges include:

- **Planning inspections on product level.** Non-compliance risks should be evaluated on a product level, as different goods, even within one family, can have different levels of non-compliance risk. The customs authority may see shipments with toys, described in the case study, as similar, while for a toy safety regulator, these shipments are associated with different levels of risk.
- **Prioritizing regulatory requirements.** Technical regulations have multiple requirements. If a shipment contains a variety of products, the regulatory authority can inspect a limited number of goods with respect to only a limited number of requirements. The challenge is choosing which feature of which product against which requirements to inspect.
- **Knowing the 'non-compliance delta'.** Border control should be focused on products with the biggest non-compliance delta – the difference between how dangerous a certain product is in a compliant and a non-compliant state.
- **Longer inspections.** Establishing conformity with technical regulations and standards requires sophisticated, costly and time-consuming conformity assessment procedures, such as laboratory tests.

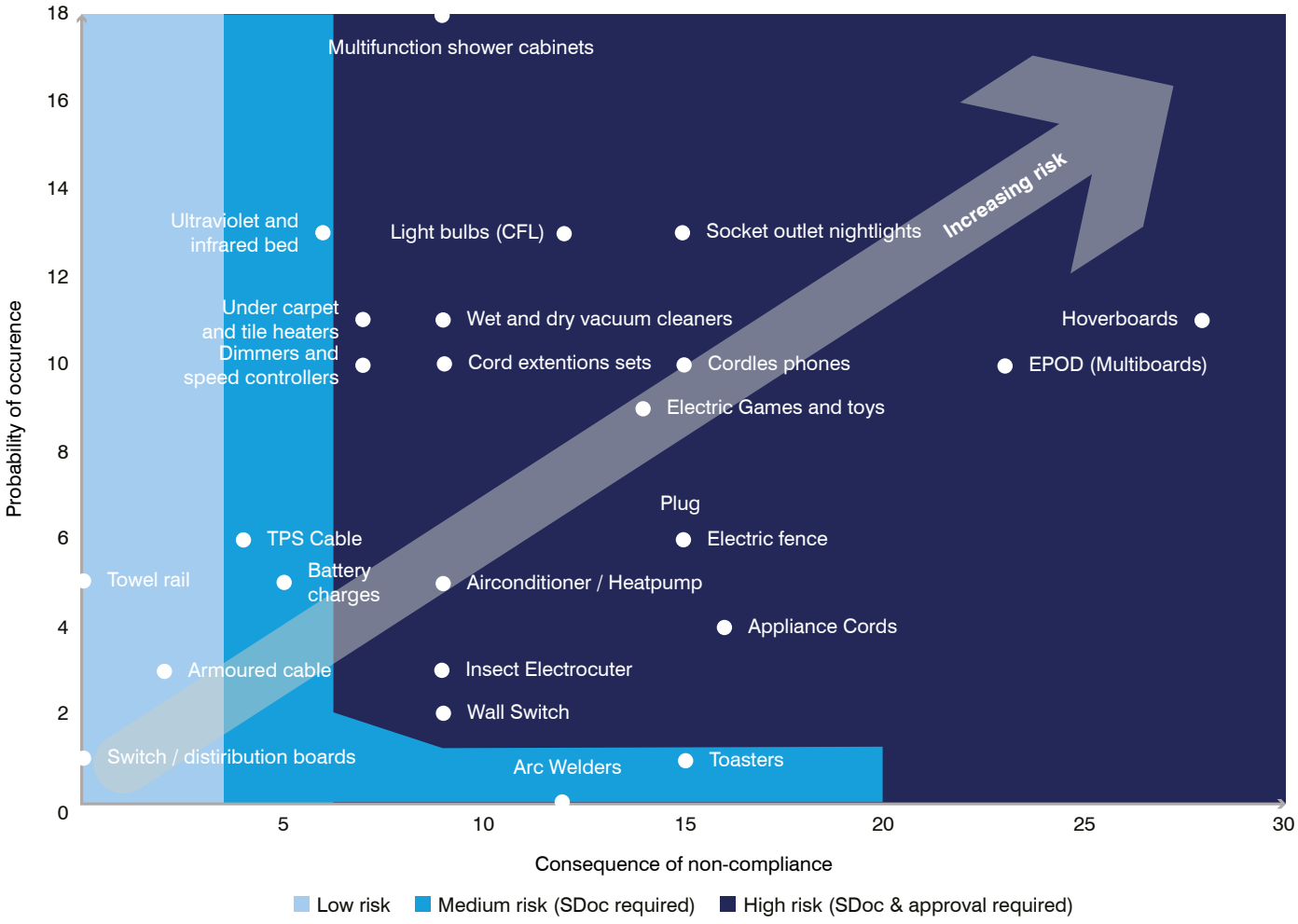
The international best practice, presented in the following pages, provides insights on how these challenges could be addressed.

Managing product non-compliance risk: International best practice[128]

New Zealand Risk Engine: Non-compliance risk of electrical appliances

The New Zealand Risk Engine[129] is a methodology to evaluate the risk of product non-compliance of electrical appliances. It is a predictive risk management tool that was developed and is being used by the New Zealand regulator (and regulators from other countries) to choose appropriate regulatory interventions.

Figure 36 Risk engine: Evaluating the non-compliance risk of appliances



Source: Peter Morfee, WorkSafe New Zealand.

- The X-axis (horizontal) is a measure of the consequences of non-compliance associated with the family of products. The scale has 30 units, and the more units a product has, the more dangerous it is when it is non-compliant. The scale is based on 30 technical factors, each of which is a feature of the product or the environment that it is being used in that makes the product more dangerous in a non-compliant state.
- For example, a technical factor for electrical appliances can be a product held in hand or one used by unsupervised children. Every product is evaluated against each factor – if a factor is relevant to the product (the product is indeed used by unsupervised children), it gets a 1; if not, a 0. The approach implies that the number of technical factors relevant to the product represents an index measuring the dangerousness of a non-compliant product.
- The Y-axis (vertical) measures the probability of finding a non-compliant product on the market. The approach is similar to that to measure the consequences of non-compliance, only different factors are used (such as 'there has been a recent change in the standard' or 'the product has high compliance costs'). On the graph, the scale contains 18 probability factors. As in the previous case, each product is evaluated against each factor and the sum of applicable factors represents the probability of non-compliance.
- Each dot on a graph represents a product within the scope of responsibility of the regulatory authority, with measures of the consequences of non-compliance and the probability to find a given product on the market in a non-compliant state.

This representation is very convenient for devising regulatory interventions. A product can be very dangerous when non-compliant, but the probability of non-compliance can be extremely low. Or the opposite: The product can have a very high probability of non-compliance, but the consequences of non-compliance can be very low. Both of these cases are less important than a situation in which the product is both dangerous when non-complaint and has a high probability of being found non-compliant on the market.

Another important approach that can be learned from the New Zealand Risk Engine is using technical and probability factors to evaluate the consequences of non-compliance and the probability of non-compliance. Although the factor approach itself is not new for risk evaluation (any hypothesis-testing technique is based on known factors), the factors that were developed by the New Zealand regulator can be very helpful.

They contain some general features that can be applied to all goods and help characterize the non-compliance risk. For example, probability factors such as 'product uses new technology' or 'there are cost disincentives for compliances' and technical factors such as 'product likely to be installed by unskilled persons' or 'product likely to be moved during uses' can be easily applied to agricultural products.

The New Zealand Risk Engine is now used in Australia and some members of the Association of Southeast Asian Nations. It has been modified to be used for gas appliances and other families of goods.

US FDA's PREDICT: Addressing food safety risks

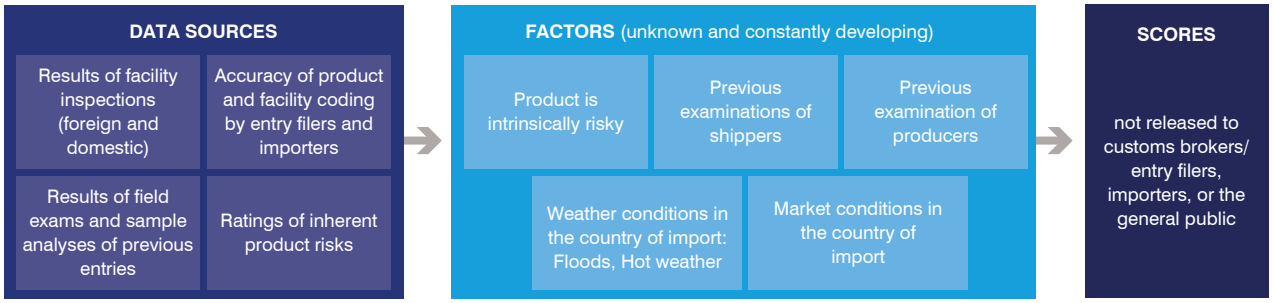
In 2011, the US Food and Drug Administration (FDA) implemented Predictive Risk-based Evaluation for Dynamic Import Compliance Targeting (PREDICT),[130] a computerized tool to improve the screening of FDA-regulated imports and the targeting of entry lines for examination. PREDICT was designed to estimate the risk of imports using information such as the history of the facility, inspection records and country of origin.

The FDA decided to introduce a risk-based approach to import inspections because of increasing volumes of imported food, which made it impractical to inspect every consignment. The FDA said it would 'face a Sisyphean task if its employees are asked to inspect everything that enters our ports'. Estimates indicate there were '20 million shipments of FDA-regulated imports handled by fewer than 500 inspectors' in 2011.

The open descriptions of the PREDICT[131] system allow us to identify some of the data sources and probability factors that are used to calculate the scores characterizing the non-compliance risk of every incoming shipment containing foods. The simplified logic of the system is shown in the figure below.

The most important principle that can be learned from the PREDICT system is not related to the nature of the data sources and to the probability factors that can be applied. This approach recognizes that non-compliance risk changes from shipment to shipment: though the consequences of non-compliance change only when the product itself changes, the probability of non-compliance differs for every shipment. The evaluation of the non-compliance risk associated with every shipment and planning of the inspections accordingly is therefore required to make the import compliance framework efficient.

Figure 37 Structure of the PREDICT system



Note: This figure is based on descriptions available in public sources.

Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

As simple as it sounds, this principle is different from many existing risk-based compliance frameworks. Risk-based inspections in many countries are designed by setting an inspection rate for a group of products that is determined on, say, a 'country of import – product' level, meaning that all products of a certain type coming from a given country are subject to the same inspection type. This approach doesn't allow consideration of many different aspects related to the supply chain associated with a given shipment, and thus may lead to biased evaluations of the non-compliance risk.

Australia's Compliance-Based Intervention Scheme: Plant protection

The non-compliance history associated with an incoming shipment is a major factor to assess the probability of non-compliance of the shipment. One can use many parameters that represent the compliance history of, say, an importer: an average compliance rate per month, total number of non-compliance cases, percentage of non-compliance cases, etc.

The approach for the best representation of the history of non-compliance was found when analysing the Compliance-Based Intervention (formerly, Inspection) Scheme run by the Australian Department of Agriculture.[132] One of the central ideas of this approach is using the number of consecutive consignments of a given product associated with a given importer and checked without any non-compliance identified as a measure of the probability that the next similar consignment (of the same product from the same importer) might contain a non-compliant commodity.

For example, this approach might imply that if five consecutive consignments of the same product of a certain importer were checked without any non-compliance in the past, a different, less stringent compliance regime can be applied for the next consignment of the same importer and of the same product in the future. For a given combination importer-product, the necessary number of consecutive consignments for applying a less stringent compliance regime can be determined by performing statistical analysis of the historic data and hypothesis testing.

In the Compliance-Based Intervention Scheme, the inspection rate is the parameter that characterizes the practical application of the framework and has the highest visibility to importers. The inspection rate is applied as a 'probability of inspection' individually to each eligible line within a consignment and can range from 10%–50% frequency.

European Union: Food, feed, animal health and plant protection

Regulation 2017/625 of the European Union 'on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products' requires EU member states, *inter alia*, to perform official controls 'on consignments upon their arrival at border control posts'. This includes 'identity checks and physical checks' at 'an appropriate frequency dependent on the risk posed by each consignment of animals or goods'.

The regulation also requires the frequency of physical checks to 'be determined and modified on the basis of risks' (to human, animal or plant health and to the environment) so the resources are allocated where 'the risk is highest'. When managing risks, competent authorities, according to the regulation, should 'make use of available datasets and information, and of computerized data collection and management systems'.

The regulation establishes uniform inspection rates for different products, which includes the minimal percentage of shipments that should be inspected in a certain period.

European Union: Manufactured products

Regulation 2019/1020 on market surveillance and compliance of products covers manufactured goods, referred to in 70 regulations and directives (listed in Annex A of the regulation).

The regulation says that 'non-compliant and unsafe products put citizens at risk, and might distort competition with economic operators selling compliant products within the Union'. It calls for stronger market surveillance by the means of, *inter alia*, intensifying compliance controls and promoting closer cross-border cooperation among enforcement authorities, including through cooperation with customs authorities.

The regulation describes an effective way to ensure that unsafe or non-compliant products are not placed on the EU market as 'to detect such products before they are released for free circulation', which essentially requires efficient management of non-compliance risk at the border. Authorities must 'carry out adequate controls on a risk assessment basis', which includes 'appropriate documentary and, where necessary, physical or laboratory checks of products before those products are released for free circulation'.

The regulation highlights the need for data exchange among authorities, including information about non-compliant products and on economic operators where a higher risk of non-compliance has been identified.

Applying reference model to targeting product non-compliance risk

In case of product compliance, the structure of a non-compliance risk is represented by lists of products, technical factors that are used to evaluate the consequences of non-compliance, and probability factors.

Building a list of products

Building a list of products is the first step to manage product non-compliance risk. Customs procedures and associated risks are structured around groups of products as they appear in the HS codes. Products that belong to the same HS code are considered to have the same level of customs risk. In contrast, with respect to compliance with technical regulations, products that belong to the same HS code group can be very different in terms of the non-compliance risks.

The Harmonized System is the most commonly used product classification. The HS comprises some 5,300 article/product descriptions that appear as headings and subheadings, arranged in 99 chapters, grouped in 21 sections.

The six digits can be broken down into three parts. The first two digits (HS-2) identify the chapter in which the goods are classified, e.g. 09 = Coffee, Tea, Maté and Spices. The next two digits (HS-4) identify groupings in that chapter, e.g. 09.02 = Tea, whether or not flavoured. The next two digits (HS-6) are even more specific, e.g. 09.02.10 Green tea (not fermented). Up to the HS-6 digit level, all countries classify products in the same way (a few exceptions exist where some countries apply old versions of the HS).[133]

HS allows participating countries to classify traded goods on a common basis for customs purposes. Indeed, defining products according to the Harmonized System codes is sufficient for the customs authorities; at the same time, products that belong to the same group HS code can be associated with different levels of non-compliance risks for product regulators.

Non-compliance risks are product specific, and different products (even belonging to the same group and sharing the same HS code) can have different levels or types of non-compliance. Dolls and pedal cars, for example, products that may have very different levels of non-compliance risk, belong to the same code – 95030095. Regulatory authorities use different definitions of products to manage the non-compliance risk.

Moreover, it is common that SPS regulators define products as a combination 'product name – country of import', so the same product coming from different countries is treated as different product, i.e. apples from Italy and apples from the United States. In general, it is possible that a shipment carrying one product from the customs perspective has a number of different goods from the perspective of a product regulator.

Some of these forms of non-compliance may be more dangerous with the potential to cause loss of life, while others may be less dangerous. Finding a balance between safety costs and potential losses requires formalizing the non-compliance risks of each product under the responsibility of the regulatory authority.

There is no common distribution of products among regulatory authorities; countries have different regulatory frameworks and different names for bodies responsible for similar groups of products.

Most commonly, the Ministry of Health is responsible for import compliance checks on foods, drugs and medical equipment; the Ministry of Agriculture is responsible for import compliance checks on agriculture products – fruit, vegetables, seeds, etc.; the Ministry of Transport performs compliance checks on transport-related products; and the Ministry of Economic Affairs is responsible for market surveillance of toys, electrical appliances and other consumer goods.

Developing a list of products under the responsibility of a regulatory authority can be challenging. UNECE calls for referring to 'international and national standards, and to the catalogues of producers/importers, as well as to other sources' when performing this task.[134]

The next two examples of product lists offer an idea of how long such lists may be. Lichtenberg and Olson studied all US fruit and vegetable imports from 2005–2014 to estimate the model of the probability of potential invasive species arrival.[135] Their product list contained 2,240 items. The paper explains that over the period, some 2.8 million shipments comprising 139 different fruit and vegetable commodities were imported from 64 countries. In agriculture, it is common for a product to be defined in terms of 'commodity/country of origin', and this explains why the number of products is so high.

Another example of product lists can be found in the description of the New Zealand Risk Engine analytical risk assessment tool. A list of electrical goods under the responsibility of the regulator contains more than 200 products.

Product inventories developed by a regulatory authority should be detailed to ensure that:

- Products in a group (a line in the table) have a similar level of non-compliance risk;
- Two product groups (two lines in a table) have different levels of non-compliance risk;
- Available data on previous inspections can be a valid source for developing a product inventory.

A product inventory may have the following structure:

Table 32 Goods with different non-compliance risk levels and the same HS code

HS code	Product name
95030095	Scooters
95030095	Pedal cars
95030095	Dolls

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Developing a list of technical factors

One approach to evaluate the consequences of non-compliance risk for a family of products is to develop a list of technical factors. This approach is applied in the New Zealand Risk Engine. It was later broadened and described in UNECE's Recommendation S.

Recommendation S defines a technical factor for a group of products as 'vulnerability that might increase the impact of any of the product-related risks when a product is in the non-compliant mode'.

According to the methodology, identification of risks related to each product within a certain family of products is essential to develop a list of technical factors. Identification of risks requires formalizing risk events and their likelihoods, as well as their impacts and set of risk factors (vulnerabilities). Most of the vulnerabilities related to product risks are also technical factors for a family of products: in most cases, non-compliance simply increases the impact of a product's risk. At the same time, a list of technical factors should also include specific safety factors that make a compliant product safer, but a non-compliant product more dangerous.

In most cases, technical factors belong to the following groups:

- Factors that increase the probability of an accident with a non-compliant product
- Factors that increase the level of harm in case of an accident with a non-compliant product

Non-compliant toys can be more, or less, dangerous. To identify factors that characterize non-compliance risks related to toys, we must imagine a non-compliant toy and think about elements that might 'exploit' non-compliance and increase the probability of an accident and its level of harm. For example, 'product needs be assembled' becomes a technical factor. In itself, this fact does not make a (compliant) toy dangerous.

However, a non-compliant product (e.g. poor materials were used) that must be assembled becomes more dangerous than a non-compliant product that does not need to be assembled. If we compare two toys in a non-compliant state, the one that must be assembled becomes more dangerous simply because a mistake in putting it together is an additional source of harm and, together with any non-compliance, increases the probability of an accident. Similarly, many other factors can be identified for toys, including the following:

- A product must be stable when a child is sitting on it
- A product can be put into a child's mouth
- A product releases kinetic energy
- A product has finger traps
- A product is dangerous without proper marking

Looking at examples of technical factors associated with electrical products as they are applied in the New Zealand Risk Engine helps demonstrate the logic behind the identification of technical factors. These include:

- **The product is likely to be moved during use:** A non-compliant electrical product that is moved is more dangerous than a non-compliant product that is not moved.

- **A product relying on guards and barriers to prevent mechanical injury:** In a non-compliant product, the guard relied on for safe use may be not functioning, thus making the product more dangerous in a non-compliant state.

- **The product is likely to be used by unsupervised or lightly supervised children:** A non-compliant product that is used by children is more dangerous than a non-compliant product that is not likely to be used by children, because children might not notice that the product is non-compliant.

Characterizing products using technical factors

To evaluate how dangerous a non-compliant product can be, a regulator needs to assess each product against every technical factor identified earlier. This can be done by building a product-risk matrix, which fully characterizes a family of products with respect to the relevant technical factors.

To demonstrate the process, let's evaluate the non-compliant risk of two electrical products – a toaster and a kettle – against the following technical factors:

- A product used by children;
- A product combining electricity and water;
- The product is likely to be moved during use;
- The product is high-powered (heat or mechanical energy).

Children can use both products. However, a kettle has both electricity and water, which means any non-compliance might make it more dangerous than a toaster (which doesn't have water).

Both products are high-powered and have hot surfaces. However, a kettle is likely to be moved during use, whereas a toaster is not. Combined with any non-conformity (e.g. related to the plastic from which a kettle is made), this factor makes a product more dangerous. A product-risk matrix characterizes every product with respect to the relevant technical factors.

Table 33 Characterizing products according to technical factors

	Kettle	Toaster
A product used by children	1	1
Product has electricity and water	1	0
Product is likely to be moved during use	1	0
Product is high-powered (heat or mechanical energy)	1	1

Note: If a factor is relevant to a product, it gets an evaluation of 1; if not, 0.

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Ranking products

Once the product-risk matrix is built, regulators can use several techniques to assess the risk of each product and to compare it with respect to its own levels of risk. The first approach is to calculate the non-compliance index for each item and to rank each respectively (in this case, a kettle ranks four and a toaster, two).

Specific combinations of technical factors may be defined in terms of having higher weights (for argument's sake, featuring a combination of factors: 'a product is high-powered' and 'a product is used by children' may have a weight more than two). Alternatively, a regulatory authority may decide that any product that is used by children and has electricity and water is high-risk. In any case, the result of this step is a table of products ranked by how dangerous each can be in the event of non-compliance:

Table 34 Ranking goods based on consequences of non-compliance

Product	Consequences of non-compliance
Kettle	4
Toaster	2

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Probability factors to target product non-compliance

Principles to build the framework of a risk-based targeting system contain three sources of evidence on which probabilities can be evaluated. These questions include:

1. **Is there anything new** in the supply chain associated with the shipment – a new product, a new supplier, a new importer, etc.? Past experience reduces the level of uncertainty, so every new element in the supply chain increases the level of uncertainty associated with a shipment.

2. **How focused** are the stakeholders involved in the import process associated with the product? The hypothesis behind this question is that importers or suppliers who work with a limited number of products have more experience and more knowledge about these products. This means the level of uncertainty associated with a shipment brought in by an importer focused on the imported goods is lower than that of an importer who works with a broader range of goods.

3. **What is the compliance history** of the stakeholders associated with the incoming shipment? This history the main source of information/evidence that helps evaluate the probability of non-compliance. Clearly, the probability that an importer who brought in many non-compliant products would bring another non-compliant product is higher than in the case of an importer who didn't have any non-compliance history.

These questions can be turned into a set of parameters that cover all the sources of information identified in the questions above. A 'something new in the supply chain' set of parameters can contain the following characteristics of the incoming shipments:

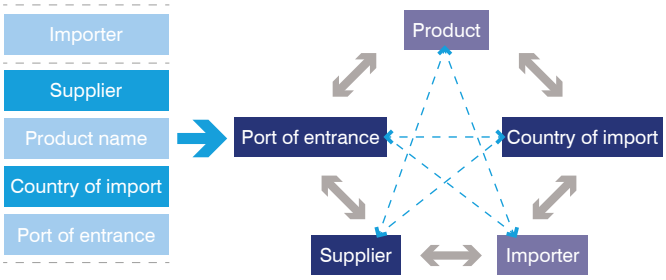
- New country/old country: Old country means that at least one product from this country was imported into the country (by any of the suppliers and importers).
- A shipment/inspection is characterized as 'new product from the country of import' when it is the first time the given product is imported from this country (the product could have been imported from other countries and other products could have been imported from the country).
- A shipment/inspection is characterized as 'new product for importer' if the importer has never imported this product before. If an importer is new, the first shipment gets a 'new product for importer' flag.
- A shipment/inspection is characterized as 'new product for supplier' if the product in the shipment has never been imported to the importing country, from this supplier (it could have been imported to other countries).

The following parameters can be introduced to see how focused stakeholders are:

- Importer's diversity: If the importer has worked with more than five different products, he/she is considered as 'very high diversity', 2–5 'medium diversity', 1 product 'single product importer'.
- Supplier's diversity (same logic as in the case of importer).

Finally, to address the compliance history of the supply chain fully, an approach of focusing on interrelationships among the various chains of the network can be applied:[136]

Figure 38 Deriving probability factors to characterize supply chain compliance history



Source: Nikonov, V., and Patir, Z. (2020).

This prediction model is based on Australia's Compliance-Based Intervention Scheme and PREDICT. In addition to the number of successful inspections that the importer passed with a given product, other supply chain combinations can be considered, e.g. how many successful checks the supplier has passed, and all other possible combinations – in other words, a number of consecutive successful inspections of 'importer-supplier', 'supplier-product', 'product-country of import', 'importer-country of import' combinations.

These parameters enable regulators to design flexible and understandable compliance rules that reflect their vision of the world.

The philosophy behind this concept reflects the real world – what is important is the stability of an importer from the

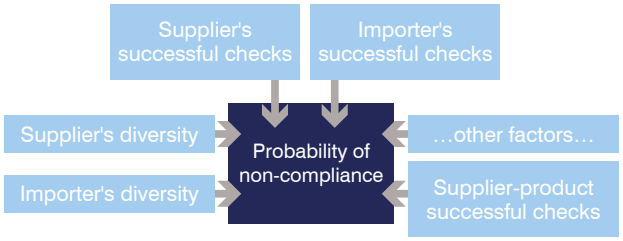
compliance status until now. The number of consecutive successful checks reflects the current compliance status.

Examples of the parameters that can be derived include:

- How many consecutive successful checks the importer has passed until the latest inspection (with all products);
- How many consecutive successful checks the supplier has passed until the latest inspection (with all products);
- How many consecutive successful checks the importer has passed with the given product;
- How many consecutive successful checks the supplier has passed with the given product.

Based on these concepts, the following parameters can be known before the shipment is inspected. They can be used as sources of evidence about the probability of non-compliance.

Figure 39 Factors to assess the probability of non-compliance



Source: Nikonov, V., and Patir, Z. (2020).

The automated system that processes basic available data (product name, importer, supplier, country) and returns a table with all the parameters described above, should be developed. Enriched with data, these probability factors can be used to build models based on the history of inspections and to run simulations for choosing optimal risk-based regulatory regimes.

Developing compliance rules and risk profiles

Evaluating a product to determine the consequences of its non-compliance is one of the two parameters that characterize the non-compliance risk of a product and are required to prioritize the import compliance processes. Even without knowing the probability of a shipment containing a non-compliant product, knowing that it contains goods that are not dangerous when non-compliant informs decisions about the priority of the shipment inspection.

Importantly, the parameter characterizing how dangerous a non-compliant product is doesn't change unless there are changes to the product itself (in the production processes or in the product design). This parameter should be reassessed regularly, but not too often (quarterly or biannually).

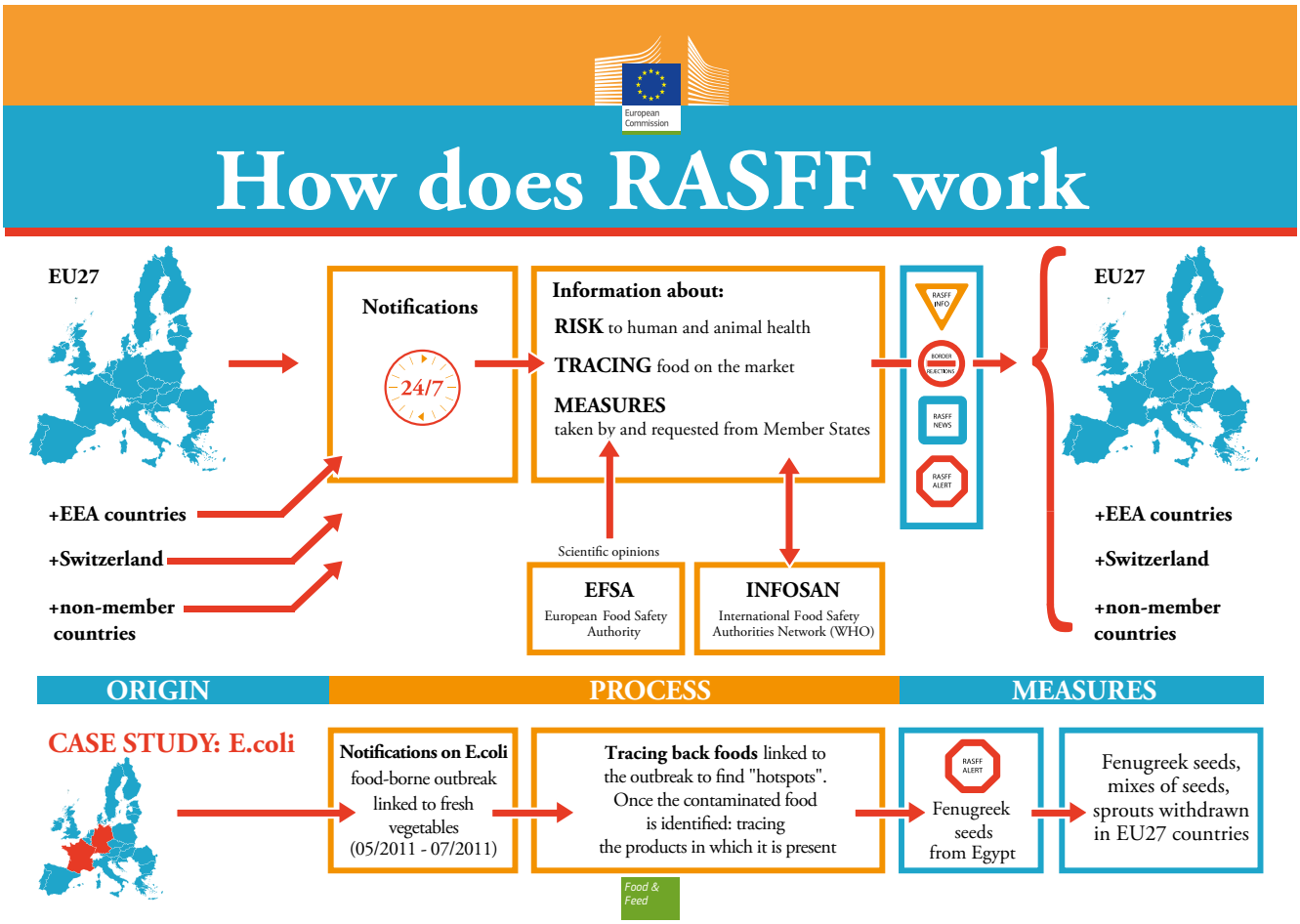
The probability of a shipment containing a non-compliant product must be evaluated. This parameter is specific to every shipment. If a choice must be made between two shipments containing the same product (the same level of non-compliance index), priority should be given to the shipment with a higher probability of non-compliance.

Regulators can use an analytical or profiling approach (or a combination of the two) to evaluate the probability that consignments do not comply with technical regulations and standards. Gathering and processing data from external sources is essential to build risk-based inspection procedures.

The Rapid Alert System for Food and Feed is an example of a system that is an external source of data on risks related to feed and food products in the European Union. It was put in place to give food and feed control authorities an effective tool to exchange information about measures taken in response to serious risks detected in relation to food or feed.

The system's notifications report on risks identified in such items. They can be classified as information notifications (when the identified risk doesn't require rapid action) or as alerts (when the identified risk related to food and feed products is serious and requires rapid action in a country other than the notifying country).

Figure 40 Information flow of the Rapid Alert System for Food and Feed



Source: European Union (2019). RASFF – The Rapid Alert System for Food and Feed – Annual Report 2019. https://op.europa.eu/en/publication-detail/-/publication/2c5c7729-0c31-11eb-bc07-01aa75ed71a1

The figure above shows the information flows of the system. Information available in such systems can be used in compliance rules to evaluate probability and consequences of non-compliance of incoming shipments.

When a predictive model is built, shipment characteristics become model variables that must be known to predict whether a shipment contains a non-compliant product. These characteristics can be derived from many parameters and can be fairly sophisticated.

Applying the Compliance-Based Intervention Scheme model, for example, requires calculating the number of consecutive successful checks that an importer with a given product has passed. The model identifies how big this number should be to ensure that the probability of compliance is sufficiently high, and this number is applied to decide whether to conduct an inspection. Applying such a model requires that when a shipment arrives in port, a regulator should know all the variables characterizing the shipment, so they can be fed into the model to obtain a prediction.

Continuing the example of the Compliance-Based Intervention Scheme model, when a shipment arrives in port, apart from the name of the importer and the imported product, the regulator should find out how many consecutive successful checks this importer has passed with this product. If these data are not efficiently gathered, it will cause delays in clearing the shipment. In many cases, cooperation and data exchange with customs can be crucial to solve this issue.

Risk-based sampling

In many regulatory frameworks, the following types of inspections are applied to an incoming shipment:

- Documentary checks
- Identity checks
- Physical checks[137]

As any inspection, especially physical checks of products, is indeed sampling (there are few cases in which an entire consignment can be inspected), regulatory authorities have to decide on the appropriate sampling strategies. After incoming shipments are prioritized according to their levels of non-compliance risk, an appropriate inspection frequency and/or sampling size should be established for each level of risk, along with other parameters that might an affect the quality of an inspection (inspector's experience and time allocated for performing inspection, for instance), to ensure that priority is given to high-risk shipments.

Materials from the risk-based sampling symposium[138] are the world's largest source of best practice in import compliance. Though focused on plants and plant products, regulatory authorities can adapt and apply the described tools and approaches to all other goods that require visual inspection.

The authorities can assign the following factors to each level of non-compliance risk of incoming shipments:

- **Inspection frequency or inspection rate** – the percentage of the shipments that will be inspected.
- **Sample size** – how many products from the shipment will be inspected. It is usually not feasible to inspect entire consignments and mainly samples obtained from a consignment will be inspected. To determine the number of samples to be taken, the regulatory authority should select a confidence level (for example, 95%), a level of detection (for example, 5%) and an acceptance number (for example, zero), and determine the efficacy of detection (for example, 80%). A sample size can be calculated from these values and the lot size.[139]

For a given acceptance number and efficacy of detection, a risk-based inspection scheme can be defined using the following structure.

Table 35 Example of a risk-based inspection scheme

	High consequences of non-compliance	Moderate consequences of non-compliance	Low consequences of non-compliance
High probability of non-compliance	Frequency: every shipment Level of detection: 0.1% Confidence level: 99%	Frequency: 50% Level of detection: 0.5% Confidence level: 99%	Frequency: 25% Level of detection: 1% Confidence level: 95%
Moderate probability of non-compliance	Frequency: every shipment Level of detection: 0.1 Confidence level: 95%	Frequency: 50% Level of detection: 0.5% Confidence level: 95%	Frequency: 10% Level of detection: 1% Confidence level: 90%
Low probability of non-compliance	Frequency: 50% Level of detection: 0.1 Confidence level: 90%	Frequency: 25% Level of detection: 0.5% Confidence level: 90%	Frequency: 5% Level of detection: 5% Confidence level: 80%

Source: Valentin Nikonov, table prepared to illustrate the methodologies described in the guide.

The sampling plan structure reflects the following logic: level of harm associated with consequences of non-compliance is reflected by the acceptable number of non-compliant goods in the consignment, represented by the parameter 'level of detection' (the bigger the consequences, the lower the level of detection).

Shipments containing goods associated with high consequences, for example, can be assigned 0.1% of allowed non-compliant products (the most stringent case in most of the sampling standards). Shipments containing products with moderate consequences of non-compliance can be inspected according to 0.5% level of detection, while in case of low consequences, the level of detection could be in the range of 1%–5%. Other things being equal, the lower detection level means a bigger sample and higher inspection costs.

The probability of non-compliance is associated with the parameter representing the probability that the number of non-compliant goods in the shipment is not higher than the level of detection, or confidence level (the higher the probability of non-compliance, the higher the confidence level). Shipments with a high probability of non-compliance can be inspected with a 99% confidence level, those of medium probability, 95%, etc.

Devising a risk-based inspection scheme similar to one presented above means resources must be shifted from low-risk shipments to those with a higher level of risk. It implies that the regulatory authority explicitly decides on the level of tolerable risks: the acceptable level of risk is determined by the number of non-compliant products of each risk group that might cross the border with a certain probability, for a given number of available resources

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Chapter 7

Integrating risk management system

Integrating risk management system

This chapter provides tools to ensure that non-compliance risks at the border are managed efficiently. This requires collaboration among the regulatory authorities and building an integrated risk management system. The risk management systems of regulatory authorities can be integrated into a single system that processes all relevant risks of each incoming shipments and ensures that border compliance costs and time are proportionate to these risks.

Cooperation can be built around the idea that regulatory authorities can help each other evaluate risk. The authorities and customs should determine if there is a correlation between interceptions on a regular basis. If there is and it is sufficiently high, it means importers who do not obey customs regulations tend to disobey technical regulations, and vice versa. Furthermore, the profiling models and rules developed by a regulatory authority will be most efficient if data-exchange processes with customs are established.

Risk evaluation will be even more efficient if customs applies the rules in their information systems. Indeed, when a shipment arrives at the port or is on its way, its characteristics should be processed according to the regulator's rules so the probability of non-compliance can be evaluated and a decision on the inspection made. Most commonly, regulatory authorities do not have online data about incoming shipments, while the customs authorities know the shipment is coming and can evaluate it.

The objectives of these changes in the management approach are trade facilitation and security. These approaches include mechanisms for regular exchange and joint assessment of information, and cross-government integration at policy and operational level.

To cooperate efficiently with border agencies on risk assessment and controls, customs authorities will need to do the following:

- Develop agreements and mechanisms for intra-organizational risk assessment, intelligence sharing and conduct of coordinated and cross-border joint control and operations;
- Develop risk assessment instruments (joint collection, development and management of risk indicators, storage and analysis of data, analysis of threats, etc.);
- Share the infrastructure – facilities, tools and equipment to inspect and examine goods;
- Create mechanisms and procedures to exchange information (strategic/tactical intelligence, operational information, inter-service communications, liaison officers);
- Create joint operating procedures (legal framework, common training, procedures, military-to-civilian reporting procedures).[140]

Benefits of integration

Integrating the risk management systems of different regulatory authorities in a single framework covers all processes and elements of a targeting system, from developing compliance rules to performing inspections. An integrated risk management system aims to optimize resources, remove duplicate functions and apply standardized methodologies.

Table 36 Benefits of integrating targeting systems

Step of the process	Strategic benefits of integration	Benefit of IT integration	Impact of integration on human resources	Impact of integration on data processing and storage
Inputs into profiling system: structure of non-compliance risk, risk tolerance and available resources	Consistent identification of non-compliant risks, risk tolerance and available resources. Standardized risk management methodology on a government level.	Identical formats of risk identification.	Regulators do not have to hire risk management experts.	Data on risks is centrally stored and protected.
Building a history dataset	A history dataset of an import compliance system as a whole.	Development of scripts for building a history dataset is centralized.	Risk management expertise is available to help regulators build a dataset.	A centralized process for storing and updating the history dataset.
Developing risk profiles and compliance rules	Correlation between non-compliance risks is explicitly considered. Cooperation among regulatory authorities.	One IT and data-mining tools used to develop compliance rules.	Expertise available to apply predictive algorithms.	Compliance rules developed within a single IT infrastructure.
Evaluating compliance rules	Simulation provide integrated data on border compliance time and costs and residual non-compliance risk.	A uniform methodology and IT system for false positive analysis.		
Applying compliance rules	Available overview of all import compliance risk associated with an incoming shipment.	Regulatory authorities do not have to invest in their own profiling systems.		One source of data on incoming shipment, minimum duplications. Compliance rules centrally stored and updated;
Performing inspections	Parallel inspections can be implemented (knowledge about all non-compliance risks).			

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Defining inputs into an integrated framework

The concept of integration

An integrated approach to develop key inputs into a risk management system involves:

- Establishing a coordinating body to integrate risk management;
- Developing guidance documents to ensure risk identification and other parameters of a risk management system are standardized;
- Raising awareness and establishing a common risk management language.

Data harmonization

Data should be harmonized to avoid submitting irrelevant or duplicate trade data to government authorities. The ultimate outcome should be one set of standardized data requirements and standardized messages that comply fully with the internationally used data model. Cross-border transactions provide the required data elements standardized messages are submitted to meet government requirements for import, export and transit. This will facilitate trade, reduce costs and help ensure more timely and accurate information.[141]

Benefits of integration: Common language, single formats and bird's eye view

Integrated identification of non-compliance risks and other key parameters of risk management systems makes it possible to analyse non-compliance risks, risk tolerance and available resources of all border control agencies, and to view an import compliance system as a whole. These parameters can be reviewed on a policy level to ensure consistency in risk tolerances and resources of regulatory agencies involved in border control and their impact on trade facilitation objectives.

Building an integrated history dataset

The concept of integration: Developing a single history dataset

It is essential to build a history data to use data-mining techniques and predictive algorithms to develop compliance rules. A history dataset that can be developed according to the structure of a non-compliance risk of a regulatory agency was presented in Chapter 4. An integrated risk management approach calls for creating a single dataset with inspection results of all regulatory agencies involved.

Benefits of integration: One storage, one format, more precise targeting

- Developing a data model of basic characteristics of a shipment and a standardized format to store data;
- Analysing correlations between the findings of different regulators and using this information in targeting.

The example shows how a history dataset of a toy regulator, where the first and third shipments are non-compliant, can be joined with a dataset of the customs authorities (which, in the case study, found all three shipments non-compliant). The resulting dataset contains the characteristics of the shipments that both authorities use (shipment number, importer, producer, country of origin and port of entrance), and those that are used by one authority but not the other (HS code is used by customs but not by toy regulators, while toy regulators use the product name).

Importantly, the joined dataset contains results of import inspections. This information can be used to perform correlation analysis and to find dependencies among non-compliance risks. Obviously, in the simple example above, the fact that a shipment does not comply with customs regulations indicates non-compliance with toy safety requirements.

Figure 41 Joining datasets of two regulatory agencies

Shipment number	Importer	Producer	Product	Country of orgin	Port of entrance	Compliance with toy safety regulation
Shipment 11	Lucky import	The best toys	Scooters	A	B	Non-compliant
Shipment 12	Lucky import	The best toys	Scooters	A	B	Compliant
Shipment 13	Lucky import	We love toys	Pedal cars	E	B	Non-compliant

Shipment number	Importer	Producer	HS Code	Country of orgin	Port of entrance	Compliance with customs regulation
Shipment 11	Lucky import	The best toys	95030095	A	B	Non-compliant
Shipment 12	Lucky import	The best toys	95030095	A	B	Non-compliant
Shipment 13	Lucky import	We love toys	95030095	E	B	Non-compliant

Shipment number	Importer	Producer	HS Code	Product	Country of orgin	Port of entrance	Compliance with toy safety regulation	Compliance with customs regulation
Shipment 11	Lucky import	The best toys	95030095	Scooters	A	B	Non-compliant	Non-compliant
Shipment 12	Lucky import	The best toys	95030095	Scooters	A	B	Compliant	Non-compliant
Shipment 13	Lucky import	We love toys	95030095	Pedal cars	E	B	Non-compliant	Non-compliant

Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

Cooperating to develop compliance rules and risk profiles

The concept of integration: Sharing risk management expertise and resources

Developing compliance rules that target high-risk shipments and inspecting imports in a way that allocates the available resources efficiently and brings the level of non-compliance risk to the level tolerable by the regulatory authority may be a challenging task that requires risk management expertise and IT tools.

An integrated approach implies that every regulatory agency develops compliance rules according to its risk tolerance and available resources. At the same time, it calls for centralized, shared expertise in risk management.

Establishing a targeting centre with risk management professionals who would help regulatory agencies develop compliance rules is an efficient way to allocate risk management expertise. Regulatory agencies would not need to hire a full-time risk management professional and or administer IT tools for developing compliance rules. Integrated development of compliance rules also helps ensure the format to build and store risk profiles is consistent.

A targeting centre usually operates on 24/7 basis and may have a nationally coordinated targeting approach that makes it easier to allocate resources effectively and efficiently through integrated targeting and operational coordination. The centre can provide a physical facility for border agencies and help governments better achieve their whole-of-government border management objectives.

At the same time, the centre can provide a common border sector agency interface for operational border management issues. It can be operated by a single agency on behalf of other authorities, and all border agencies could be invited to join and work there. This has enabled better planning, coordination (joint targeting) and response actions contributing towards more efficient and cost-effective delivery of whole-of-government border management goals.

Even though one agency hosts the centre, each participating organization keeps its agency-specific mission, role and identity. This encourages wider buy-in to the concept and enables governments to achieve common approaches without destabilizing wider institutional and agency arrangements.

Example

For the purposes of the case study, the two regulatory authorities developed the following set of rules:

- Toy safety regulator: If an importer brings a product from a new producer, it is a high-risk shipment; other shipments are low-risk;
- Customs authority: HS code '95030095' and country of origin 'A' – a high-risk shipment.

Cooperation in developing compliance rules and risk profiles includes the following main elements:

- Sharing data
- Correlation in non-compliance risks
- Using the best IT infrastructure available
    - Information system
    - Data-mining systems

Evaluating a targeting system: Integrated overview

The concept of integration: An integrated dataset

Simulating how all regulatory authorities would have performed at the border if they had worked according to the developed compliance rules provides information about the import compliance system as a whole. Importantly, it allows border compliance costs and time for importers to be calculated and reviewed in the context of 'overall' residual risk of non-compliance.

To evaluate the compliance rules of all regulatory authorities and to simulate how they would have behaved at the border requires an integrated history dataset that includes all risk factors necessary to apply the compliance rules of all regulatory authorities.

An integrated dataset that allows a simulation of how the customs authorities and the toy safety regulator would have inspected the arriving shipments must contain the fields that allow the compliance rules described above to be applied. The table should show whether an importer is bringing a product from a new producer (required to apply the compliance rules of the toy safety regulator), the HS code and the country of import (to apply the compliance rules of the customs authority).

This dataset can be derived from the basic history set in the following way:

Figure 42 Dataset to simulate application of compliance rules of two regulators

Shipment number	Importer	Producer	HS Code	Product	Country of orgin	Port of entrance
Shipment 4	Lucky import	We love toys	95030095	Pedal cars	A	B
Shipment 5	Lucky import	Toys of the world	95030095	Scooters	C	D
Shipment 6	Lucky import	Toys of the world	95030095	Scooters	C	D

Shipment number	New product for producer	HS Code	Country of orgin
Shipment 4	0	95030095	A
Shipment 5	1	95030095	C
Shipment 6	0	95030095	C

Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

The integrated table allows simultaneous simulation of all compliance rules. It performs false positive analysis, evaluates the efficiency of predictions and allows an assessment of the border compliance time and costs that importers would have experienced if the compliance rules had been applied.

Figure 43 Results of a simulation

Shipment number	Actual compliance / toy safety regulations	Actual compliance / customs regulations
Shipment 4	Compliant	Non-compliant
Shipment 5	Non-compliant	Non-compliant
Shipment 6	Compliant	Compliant

Shipment number	Predicted compliance / toy safety regulations	Predicted compliance / customs regulations
Shipment 4	Compliant	Non-compliant
Shipment 5	Non-compliant	Compliant
Shipment 6	Compliant	Compliant

Source: Valentin Nikonov. Figure prepared to illustrate the methodologies described in the guide.

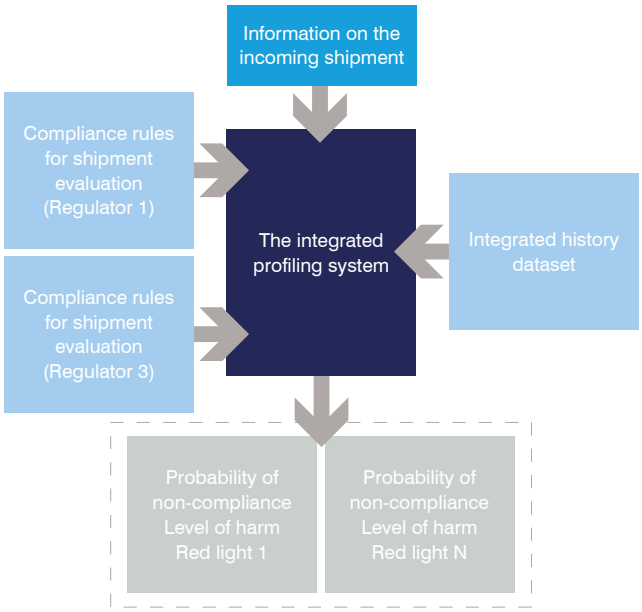
Analysis of the predictions shows one false negative (the fifth shipment) and allows border compliance time of the whole import compliance system to be calculated. If customs and toy safety inspections each last an hour, the regulatory regime would result in two hours of compliance time.

Performing integrated simulations means the trade facilitation and risk parameters of the import compliance framework can be evaluated as a whole and ensures centralized data storage.

One data source, one system

Applying compliance rules usually requires basic information about the incoming shipment and an information system that can compare the characteristics of the incoming shipment with the conditions of the compliance rules. The integrated approach for import compliance implies using one source of data on the incoming shipments and processing all compliance rules within one information system.

Figure 44 Reference model of an integrated risk management framework



Source: UNECE (2019). Recommendation V on 'Addressing product non-compliance risk in international trade'. Available at https://unece.org/sites/default/files/2022-04/Recommendation_V_E.pdf.

The main steps of the process include:

- Regulatory authorities transfer compliance rules to the integrated profiling system;
- To apply these rules, the system builds an integrated history dataset that includes all risk factors used in compliance rules developed by regulatory authorities;
- When a shipment arrives, the system gets its characteristics from the integrated history dataset;
- The system applies the conditions of the compliance rules and returns results to regulatory authorities.

Example

To illustrate the integration concept, an assumption can be made that information on the incoming shipment is represented by the following data:

Shipment number	Importer	Producer	Product	Country of orgin	Port of entrance
Shipment 4	Lucky import	The best toys	Dolls	A	B

The integrated profiling system received the compliance rules of the customs authorities and the toy safety regulator. To apply the rules, the history dataset information must show an integrated system whether shipment 7 contains a product from an unknown producer. Applying customs compliance rules, in this case, doesn't require a dataset – they include only basic characteristics of a shipment.

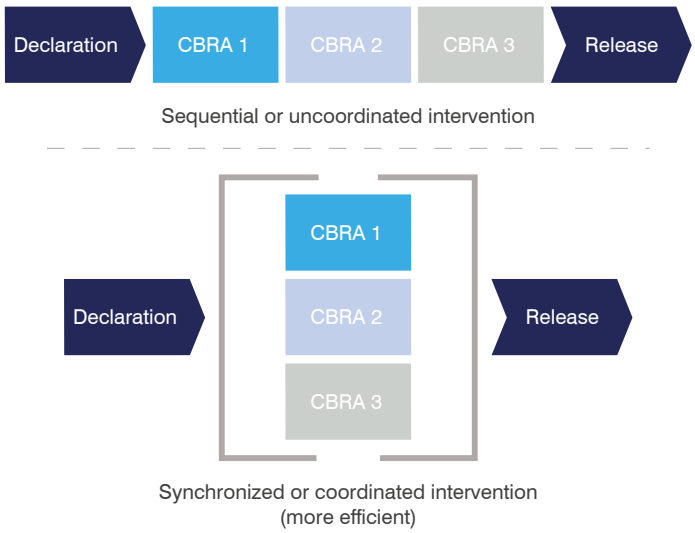
Result of the prediction that the system would be:

Shipment number	Predicted compliance with toy safety regulations	Predicted compliance with customs regulations
Shipment 7	Non-compliant	Non-compliant

Integrated inspections

Integrated evaluation of the incoming shipment enables regulatory authorities to optimize the inspection time by conducting parallel inspections and delegating an inspection to one authority.

Figure 45 Sequential vs. synchronized intervention



Note: CBRA stands for customs border regulatory authority.

Source: Irfan Sarfraz, elaborated for this guide.

Customs as lead agency

- Choosing a lead agency is a political and strategic issue. In many countries, customs is selected as lead agency to implement an integrated risk management approach while all participating agencies undertake a coordinate process to reengineer both legal and technology platforms.[142] Customs authorities play a central role in border control and the most efficient way to build an integrated risk management framework is to use the customs IT infrastructure as a basis.
- Customs regulations cover every incoming shipment, while most regulatory authorities regulate a subset of the total trade volume;
- Customs authorities work according to an international data model;
- Customs authorities have advanced information systems;
- Customs authorities in more than 90 countries use the United Nations-developed IT system ASYCUDA, which contains a module for risk management. A standard integrated system can be developed.
- Customs authorities gather substantial expertise in risk management.

Product non-compliance risk management can be integrated into the customs clearance process, as described on page 100 of the OSCE/UNECE 2012 handbook. Cooperation can be built around the following functions in the clearance process:

1. Cargo declaration by carrier to customs upon the arrival of goods or by means of advance declarations;
2. Preparation and submission of goods declaration by the importer/broker either on paper or electronically, most commonly before the goods arrive;
3. Automated risk management/channelling and selecting shipment for checks according to data analysis in the declaration;
4. Checking the goods declaration and supporting documents;
5. Physical inspection of the goods can take the form of a non-intrusive inspection with equipment such as X-ray or a manual inspection;
6. Release of goods by customs.

The integrated application of the compliance rules can be described as follows:

1. The regulatory authority builds a historic dataset and develops models and rules to evaluate the probabilities that incoming shipments contain non-compliant products.
2. Regulatory authorities pass the rules to the customs authorities for implementation.
3. Customs authorities add the regulator's profiling rules to their profiling system as a separate module.
4. When a shipment is on its way to the port, the customs authorities process the data so information about the shipment needed to run the predictive algorithms of the regulatory authority and customs is gathered;

5. Customs authorities apply both profiling algorithms and their rules, as well as those of the regulatory authority, and obtain the following evaluations:

    a. The probability that the shipment does not comply with the customs regulations.

    b. The probability that the shipment does not comply with the technical regulations.

6. The customs selection module channels the declaration to red, orange and green channels, according to the evaluation of the customs risk.

7. The customs authority returns the evaluation of the probability that the shipment is non-compliant with the regulatory authority, so it can combine the evaluation of the probability that goods in the consignment are non-compliant with the evaluation of the danger level of a non-compliant product.

8. The regulatory authority decides whether a shipment should be checked and, if so, the required level of scrutiny.

9. 'Physical inspection of goods' is an optional phase both for customs and product regulatory authorities. Integrated risk management can result in a situation where customs checks a shipment but product regulators do not; product regulators check but customs does not, neither authority checks or both check.

10. After any checks are performed, the regulatory authority tells customs that the shipment can be cleared.

11. The regulatory authority updates the dataset with historic data, updates the predictive models and rules, and sends the updated version to customs. .

Implementing this process will lead to effective cooperation between regulatory authorities and customs. According to the OSCE/UNECE 2012 handbook, 'customs authorities are most often responsible for introducing border coordination activities'. Customs authorities could use this process to initiate projects for cooperating with other regulatory agencies.

ASYCUDA as basis for integration

ASYCUDA, a computerized management system used in more than 90 countries, covers most foreign trade procedures.

Risk is managed in the system via a selectivity module, which can be used to implement simple import compliance rules.

Selecting the examination procedure for the goods is assisted by the selectivity module based on information in the criteria files. The system will allocate a 'channel' status of green (the cargo will be released without examination), yellow (the cargo will be released after further documentary validation), red (the cargo will be released after a physical examination) or blue (post audit control).

The criteria files are built using national and local control file data. Based on their nature, data elements are compared individually and/or in combination with the criteria in the control files. The results of such risk analysis should be analysed periodically to maintain, change, extend or eliminate certain parameters.

One data element or a combination of elements may be chosen to build a criteria.

The selection criteria will managed at central level, i.e. criteria to be used by all customs offices in the country, or at local level for criteria used at individual offices.

Almost every data element in the declaration can be selected. Examples of selection parameters:

- importer/declarant
- customs value
- commodity code
- means/mode of transport
- country of origin/consignment
- random checks (e.g. every 20 declarations)

The selectivity module functions as a filtre through which all declarations must pass. If the data elements of the declaration correspond to those of the selectivity criteria, routing to documentary check, a physical examination or flagging for post audit control is carried out.

Example: If the criteria are set to identify goods, say television sets tariff heading 85.28 with a particular origin e.g. Japan (country code JP), the system will select all declarations with country code JP and tariff heading No 85.28 for examination (yellow, red or blue). The number of declarations selected can be controlled by assigning a percentage of 'hits' to each channel.

Overriding a system selection will be allowed only under special circumstances, and only after instruction by the officer in charge. Such cases are recorded separately.

Organizing integration

In 2011, the WCO published a study report on risk assessment/targeting centres.[143] According to the study, targeting centres allow countries better:

- Management and fusion of information;
- Application of a nationally coordinated approach to risk assessment and targeting;
- Coordination of intelligence and operational activities;
- Ability to manage border risks holistically across the border.

All the objectives of the targeting centres overlap with those of integrated risk management.

The single window

Integrated risk management builds on and broadens the scope of the single window, a system where trade-related information and/or documents need only be submitted once at a single entry point to fulfil all import, export and transit-related regulatory requirements.[144] UN/CEFACT Recommendation 33 urges participating authorities and agencies to coordinate their respective controls through the single window and consider facilitating payment of duties, taxes and fees.

The rationale for developing single window can be easily applied to integrated risk management. Companies involved in international trade often must deal with import controls performed by different agencies. Many of these controls are not proportionate to the risks they sought to address, because the risk management infrastructure of regulatory agencies is inefficient.

Integrated risk management can be perceived as an analogy to the single window, where information about the incoming shipment needs only be processed by one integrated system that assesses all non-compliance risks under the responsibility of all regulatory agencies, according to the compliance rules and risk profiles developed by these agencies.

Project planning

Building an integrated risk-based import compliance system is a complex project from organizational, methodological and technological perspectives. Its implementation depends greatly on the IT infrastructure and risk management maturity of the regulatory agencies involved. A structure of a project plan described in the following sections can be used as a basis to develop a project plan on a country level. The project plan contains the following main phases:

- Setting the context;
- Building risk-based regulatory systems;
- Developing methodologies to manage non-compliance risk in every regulatory agency;
- Building a risk assessment process.

Setting the context

This phase aims to create an organizational structure suitable for building an integrated risk management system. The phase contains the following tasks:

- Determining the lead agency and a project management committee;
- Identifying regulatory agencies to participate in the system;
- Creating awareness – ensuring common understanding of terms, objectives and processes;
- Building centralized risk management expertise;
- Building suitable IT infrastructure – data-mining and data-processing tools.

Building risk-based regulatory systems and import compliance frameworks

This phase seeks to ensure that import compliance frameworks are balanced with other elements of respective regulatory systems. UNECE describes the methodology to build risk-based regulatory systems.[145]

Developing methodologies to manage non-compliance risk in all regulatory agencies

This phase aims to ensure development of standardized and proportionate compliance rules by all regulatory agencies. It includes the following tasks:

- Developing a list of products
- Defining a product
- Gathering import compliance data and building a list of products
- Evaluating the consequences of non-compliance of products within the scope:
  - Developing a list of technical factors
    - Factors, increasing the consequences of an accident with a non-compliance product
    - Factors, increasing the probability of an accident of a non-compliant product
    - Factors, increasing the probability of non-compliance
  - Evaluating products against each technical factor (relevant or not)
  - Product ranking
- Evaluating the probability of non-compliance
  - Developing a list of probability factors
  - Gathering basic import data
  - Adding probability factors to the dataset
- Building risk profiles and compliance rules for evaluating the probability of non-compliance of an incoming shipment
- Evaluating compliance rules based on both consequences and probability of non-compliance
- Developing an import inspection policy based on compliance rules, including risk-based sampling.

Building a risk assessment process

This phase aims to develop an IT and methodological infrastructure to assess the incoming shipments with the compliance rules of various regulatory agencies. It includes the following tasks:

- Developing IT infrastructure to apply compliance rules in a lead agency;
- Developing tools to process data on incoming shipments according to the requirements of participating regulatory bodies;
- Developing tools to apply the compliance rules.

Building an integrated system

This phase includes the following tasks:

- Building an integrated dataset at the lead agency;
- Integrating compliance rules and evaluating an import compliance framework;
- Running a pilot project to assess the incoming shipments according to the compliance rules of all regulatory authorities (without changes in inspections);
- Full implementation (going live).

Chapter 8

The critical role of business

The critical role of business

The benefits of compliance

One objective of risk management is to lower the cost for businesses when transacting with the government. The adoption of a risk management approach by government regulatory agencies presents tangible benefits to those involved in legal and legitimate trade. Businesses can best take advantage of this opportunity if their internal processes are geared towards achieving better compliance with regulatory requirements.

Risk management creates client segmentation based on a company's level of compliance with trade laws and regulations. The better the compliance history of a business, the lower the chance of intervention at border points, which means cost and time saving for high-performance firms. Economic operators with a consistent track record of compliance, and no major errors or anomalies in their declarations, receive predictable treatment and faster clearance.

Other benefits for businesses include simplified procedures, periodic filing and deferred payments.[146] Many administrations have implemented schemes such as trusted traders or accredited clients, which promote a culture of compliance and save costs for businesses with a strong track record.

High-performance businesses should adopt a risk management approach. An ITC publication, A Practical Guide for SMEs – ISO 31000 Risk Management, offers guidance for businesses on how to predict risks and put in place systems to minimize negative consequences.[147]

Active role of traders is critical for improvement

The business community plays an important role in improving trade compliance and economic operators must understand their risks and responsibilities. An efficient and compliant import or export process means that participants have a clear understanding of this, with processes that ensure that all reasonable standards and regulatory requirements are met.

Businesses should ensure in their internal processes that all managers dealing with international trade matters carefully prepare, review and monitor declaration requirements. This safeguards their ability to engage in business transactions with government in a smooth, predictable manner.

Collaboration is a win-win for regulators and trade

Regulatory administrations view legitimate traders as partners in the risk management and trade facilitation process. Good communication, consultation and cooperation between trading businesses and regulatory administrations are vital to balance control and facilitate trade. Collaboration helps regulatory administrations understand trade practices while knowledge about trends in international trade improves risk management.

Many administrations maintain formal consultative committees with traders, carriers, agents, banks, port and airport operators, and their representative organizations. These committees typically discuss projected changes in control requirements, identify difficulties declarants face in complying with actual or proposed procedures and arrive at mutually acceptable solutions. Some administrations have client coordinators who work to improve communications with individual companies.

Businesses should play a positive role in these processes. There should be regular collaboration at all levels – at the local/regional level between officials of regulatory agencies and companies, and at the national level among customs and other regulatory agencies, administrations and businesses. This helps firms understand regulations so they can suggest how to align policies and processes with business realities.

Stay informed

Information about customs procedures and control requirements must be readily available. Sources may include the customs tariff, official gazettes, bulletins and notices. This helps manage compliance and prevents surprises and problems. Customs administrations use

modern techniques to disseminate information, and such channels should be regularly and frequently used.

Government organizations can be asked to offer training in specific areas. Tools should include seminars, workshops and training opportunities.

Businesses should subscribe to information channels that notify changes in operational procedures – such as customs' administrative notifications, public notices, standing orders and instructions – and keep an organized office library of all such documents. They should also subscribe to legal gazettes to have updated copies of the customs act, tariffs, rules, regulations and case law.

Watch for sector-specific regulatory changes

Governments sometimes impose dumping duties, safeguards and countervailing or regulatory duties. In addition, countries and regional blocs occasionally review and modify trade agreements. It is important to keep up with such updates and share relevant information with all managers, staff and clients.

Support regulatory agencies with trusted and credible information

Cooperation is valuable for regulatory agencies seeking to combat illicit trade activities (e.g. drugs, fake products). National administrations encourage cooperation through memoranda of understanding with trade organizations at both the national and international levels. This should be supported by detailed guidelines.

Customs-to-company memoranda and guidelines can lead to memoranda of understanding that benefit both regulatory agencies and the trade organization. They provide regulatory agencies with valuable information about risk management while traders with a good record of cooperation can expect less intervention and interference from customs.

Provide evidence-based, quality inputs during policy changes

Governments and customs departments generally ask for input from businesses before any major policy changes. Businesses can use this opportunity to give useful, evidence-based information to governments. Often, in developing countries, data and analysis do not support information provided by companies. Firms should develop this capacity and become credible partners in the policy consultation process.

Show due diligence in compliance procedures

Businesses must demonstrate due diligence in regulatory compliance procedures and should use all information channels to remain updated and ensure that all proper protocols (such as documentation requirements) are followed.

Government administrations increasingly treat their clients on the basis of their profiles and compliance history. Even where customs audits are not advanced, evidence of errors or variance between declarations and customs assessments can be damaging. These can be prevented through greater due diligence.

When errors occur, it is important to determine the cause and ensure that a process is in place to prevent recurrences. It may be a staff training issue or a failure to receive updates on legal changes. It becomes more vital when administrations move towards self-assessment and risk management-based approaches.

Have pre-compliance processes and a 'reasonable care' checklist

Governments expect declarants to use reasonable care in reporting classification (i.e. HS codes), value, country of origin and duty preference programme. Regulatory agencies have the right to check that traders are using reasonable care and submitting accurate information.

Businesses may develop their own sector- and process-specific checklists to ensure reasonable care, e.g.:

- For classification (HS code), use a credible system that provides tariff search and classification assistance;
- That quantity, unit of measurement, value and currency are correctly entered;
- That the correct procedures have been applied;
- That policy conditions are satisfied.

It is important to have prefilings (internal processes to validate the declaration against the original information and documents, before the declaration is filed and transmitted to the customs system) and robust internal review processes in place when providing information to government agencies. Inadvertent errors identified before agencies have noticed must be reported immediately. Refiling a corrected version of an erroneous disclosure may reduce potential penalties from agencies.

Compliance can also be improved through better internal processes and controls, such as keeping a record of each import transmission and related customs messages and form images; reviewing each declaration or information before filing it to customs or other agencies; and ensuring a swift response to messages and information requests from customs or other agencies.

A checklist will help improve compliance and should contain items including:

All declarations and information submissions

- Review of all documentation and supporting documents for accuracy;
- Consistency in the same or similar transactions across ports and modes of transport;
- Appropriate adjustments or prior disclosures when errors are discovered before customs systems begin checking or initiating action.

Cargo and goods description and tariff classification

- Having procedures in place to ensure full knowledge of the goods you are importing, such as composition, country of origin, etc.;
- Properly describing the merchandise to the customs system according to the regulations;
- Ensuring the correct tariff classification of goods is provided;
- Verifying whether the goods are eligible for specific duty-free status.

Valuation

- Correct valuation method under General Agreement on Tariffs and Trade code – ensuring accuracy of your declared transaction value, according to customs requirements;
- Are your transactions between 'related' parties, and if so, have you ensured you are declaring the correct values to customs?
- Commissions, royalties, etc., declared as appropriate.

Country of origin/marking/quota

- Reliable procedures in place to ensure that the country of origin is declared correctly;
- Country regulations may have special marking or labelling requirements, e.g. marking with the country of origin/manufacture;
- Processes established to determine and ensure that all necessary documentation is provided at time of entry.

Intellectual property rights

- Ensure that any trademark or copyright is not being violated.

Have an internal audit focusing on regulatory compliance

An internal audit will help identify risks and improve regulatory compliance in international trade transactions. Agencies conduct post-clearance audits to ensure that businesses subject to regulatory controls have fully complied with all relevant legislation and requirements. Legal and regulatory provisions generally specify what documentation or records firms should maintain for audit purposes. Such requirements from customs, value-added tax or other agencies provide a good checklist for businesses preparing an internal audit plan.

Knowing your obligations as an auditee is important, and a regulatory agency audit is meant to ensure compliance in all areas. Audits confirm that:

- All third-country imports and exports are properly declared;
- All goods entered to a customs procedure are properly declared;
- Import and export prohibitions and restrictions (licence, quota, etc.) are observed;
- Documentation declared is in accordance with the national legislation on valuation for purposes of customs declaration and other taxes (value-added tax or excise);
- Conditions of approval are observed and all duties related to diversions, home consumption, etc., are paid;
- Declarants are fulfilling their obligation to retain all supporting documents for the period as required by legislation;

- Operators using a simplified procedure are complying with the conditions in each case and there is no abuse in their use of these facilities;
- All excisable goods entered for operation are properly accounted for and all losses are genuine, properly recorded and maintained within allowable parameters;
- All goods leaving tax or customs warehouses are accompanied by the correct documentation and covered by a guarantee or bond where applicable;
- All goods removed from a warehouse under a duty-suspended procedure complete the declared procedure and are properly receipted;
- All duties are properly calculated, covered by adequate deferred guarantees or bonds, and paid by the appropriate date.

Continuous training of staff and managers

A key to increasing compliance is to ensure a trained and professional workforce. Businesses should be in touch with customs training organizations that can help organize up-skilling programmes for their community. Always organize orientation exercises for new staff. A proper takeover process should be in place when workers are replaced.

Personnel must understand the cost of non-compliance. Staff who prepare and handle documentation and records for filing to customs or tax authorities must be well trained and aware of the implications of making errors and how much it can cost their company or clients, in terms of delays, penalties and compliance rating.

Use sound documentation practices

An organized and complete documentation process is the best protection to ensure that risk management remains in place even when an important staff member leaves the organization.

Regarding transactions filed with customs agencies, always ensure that the organization knows the legal requirements vis-à-vis the time period necessary for retaining records for government audit purpose.

Use available channels for advance rulings and reviews

Many administrations have some form of advance ruling process in place. Whether that ruling is binding or not, it provides information and clarity to the requester. Such processes must be used whenever in doubt or need of clarification.

Have a documented compliance plan

Larger businesses should have a documented compliance strategy. While this may not be feasible for small and medium-sized enterprises, they should develop certain processes and checklists for internal controls.

The compliance plan may include:

- Definition of who is responsible for compliance, for each part of the import or export process;
- Enhanced accountability;
- Provision of safeguards and controls to ensure consistent processing and decision-making;
- Communication of ‘red flags’ that require additional transaction scrutiny;
- Tools and training to ensure employees are following compliance procedures.

Know the parties with whom you are doing business[148]

Border agency risk management systems evaluate risks on business transactions, taking account of the profile of participants (the carrier, custodian, agents, and even shippers, manufacturers and other parties on the other side of the border). Importers and exporters must select customs brokers or agents who are professional and have good reputations.

One of the least understood aspects of exporting is the need to verify the final user and destination of your products. Your goods must not be resold to a sanctioned entity or country or repurposed by a sanctioned party. Therefore, you need to know not only the country and buyer to which you sell, but also that buyer’s likely customers for your products.

Commerce and state departments and treasuries should manage lists of prohibited entities, individuals and countries. Your company is responsible for knowing all parties involved in your transaction, such as shipping companies, freight forwarders, insurance brokers and end users, and whether they are on such a list.

These government lists can change daily and should be checked at each stage of a transaction, from beginning to end. To help comply with these requirements, you may wish to consult your legal advisers on terms to include in your sales agreement.

Use accredited and compliant-operator schemes

Many administrations have accredited parties or client processes, and eligibility criteria are notified. Such accredited clients have tangible benefits, in terms of ease and predictability of their business transactions with border agency system.

Since the adoption of the WCO SAFE Framework in June 2005, several countries have introduced authorized economic operator or AEO-type programmes. The benefits of these programmes for accredited AEOs include:

- Mutual recognition of AEO status by customs administrations;
- Expedited processing and release of shipments, supported by regular 'time required for release' studies;
- Financial guarantee waivers, reductions or rebates;
- Notification of intention to release before goods arrive (pre-clearance);
- Pre-qualification for simplified procedures, including possibilities for a single-step process, or a two-step process for release/clearance purposes, according to the importer's preference;
- Establishment of economic operator-based profiles and audit-based controls, as opposed to transaction-based controls;
- Prioritized inspection and use of non-intrusive inspection equipment when a physical examination is required;
- Priority customs processing during elevated threat conditions;
- Priority treatment in post-incident resumptions and trade recovery programmes;
- They are a key factor in determining the administrative settlement of a customs offence (consistent with Annex H, Chapter 1, Standard 23 and Standard 3.39 of the revised Kyoto Convention);
- Self-assessment when customs' automated systems are not functioning;
- Option to provide a reduced standard dataset for security risk assessment purposes.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Appendices

Appendix I

Appendix I

Key concepts, recommendations and methodologies

Integrated risk management as a trade facilitation measure

International trade is a major driver of economic growth, poverty reduction and sustainable development. Achieving most of the Sustainable Development Goals (SDGs) depends on the availability and compliance of goods that are traded on international markets (e.g. vaccines and medical equipment for SDG 3).

The safety of international trade is as important as its efficiency. While trade represents an opportunity, it has always been a source of risks; it was in the context of cross-border trade that many risk management tools were first introduced.

International trade risks can be described at different levels. Major trade risks that are managed on the policy level stem from the uncertainty associated with demand and supply of traded products.

Regulatory authorities deal with a diverse group of risks that are associated with traded products and can have undesirable impact on consumers, society and the environment. These risks require regulatory intervention and management of non-compliance risk at the border.

Indeed, a shipment arriving at a border can be in violation of the requirements of several regulatory systems and thus be a source of many risks. These risks can be grouped as customs and security risks, risks of product non-compliance with technical regulations and standards, as well as sanitary and phytosanitary (SPS) risks. Principles to manage such risks are described in international trade accords and conventions, including World Trade Organization agreements.

Growth in trade in manufactured products, regional integration, new technologies and security challenges contribute to the greater significance of non-compliance risks. Product non-compliance and SPS risks are similar to customs risk in many respects.

At the same time, risk management best practice, including tools developed for customs authorities, should be adapted to the specifics of these risks. Efficient management of non-compliance risks requires product evaluation (in contrast to shipment evaluation); more sophisticated, costly and time-consuming conformity assessment procedures, such as laboratory tests; and different product groupings.

The UNECE International Supply Chain Reference Model, which visualizes the steps in the supply chain and models commodity trade across national borders, can be used to develop a comprehensive map of risks that exporters and importers face. The latter are exposed to the following risks: business, supplier, quality, credit and currency, transportation and logistics, and legal. Trade disruption risks – stemming from inadequate and disproportionate border compliance procedures and leading to unnecessary and/or sequential inspections – and the uncertainty that stems from them create extra and unexpected costs for exporters and importers.

Data analysis shows that border compliance procedures are very time-consuming and uncertain in most of the regions of the world. Trade facilitation is a key policy measure that countries apply to reduce uncertainty and costs for importers. Inspections are the main cause of delays and uncertainty of border compliance, and risk management, as a basis for deciding whether a shipment should be physically checked, is one of the key trade facilitation measures listed in the WTO Trade Facilitation Agreement (TFA).

Risk management implementation in border control remains one of the five measures with lowest implementation, according to the TFA database, with 31.4% of future implementation commitments that depend on the receipt of capacity-building support.

Even countries that fully implemented risk management in 2015–2019 still need to improve the efficiency of their border procedures, as compliance times have not decreased substantially. Possible causes for this include inefficient risk management by regulatory agencies involved in border control and lack of integrated risk management, which can reduce uncertainty and lower border compliance times and costs.

Choosing best actions in response to risks: Principles of risk management

Border control agencies have always managed risks, though this was often intuitive and non-systemic. Biases associated with intuitive judgements of risks, especially of probabilities (the central parameter of any risks) are caused by the fact that people substitute probability with other heuristics. Formal risk management methodologies help avoid errors in risk perception. All regulatory stakeholders involved in international trade must apply them to build an integrated risk-based import compliance framework at the border.

The internationally recognized definition of risk is 'effect of uncertainty on objectives'. In practice, risks are often confused with risk events or their impacts. To avoid many risk perception errors, risks need to be described in terms of risk sources, potential events, their consequences and their likelihoods.

Good risk management results in best actions in response to risks – those that make it possible to find the right balance between the following parameters: the reward associated with the achievement of the objectives, associated with the activity that contains a risk, the potential impact of a risk and the costs of actions chosen to address the risk.

Best actions in response to risk can be chosen from the following risk treatment strategies: modifying a risk, accepting a risk, transferring a risk and avoiding a risk.

Table 37 Criteria to choose risk treatment strategies

Strategy	Situation, in which it is a best response	Situations, in which it is not the best response to risk
Modifying (mitigating) a risk	Optimal way to mitigate the risk is chosen Cost of risk mitigation is proportionate to potential losses Risk mitigation brings the risk to the desired level	The residual risk still remains too high Mitigation costs exceed the reward associated with the main activity (or are not proportionate to the reward)
Accepting the risk	There is no efficient way to modify the risk The business wants to accept the risk The stakes are high enough	The level of the accepted risk is higher than the actual level of risk that the business is willing to accept
Avoiding a risk	Risk that is not tolerable that cannot be modified and thus brought to the required level Risk mitigation costs exceed the reward from the main activity	There are proportionate risk mitigation measures Risk avoidance chosen because of the risk perception biases (fears)
Risk transfer	Transferring a risk is an optimal strategy (compared to risk mitigation)	Transferring a risk will create higher risks

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Risk tolerance is 'readiness to bear the risk after risk treatment in order to achieve the objectives'. In business environment, risk tolerance can be influenced by regulatory requirements; for a regulatory authority, risk tolerance is impacted by societal expectations.

Zero risk is not and cannot be a valid risk management objective. Not only because uncertainty will always be present and new unknown risks will emerge, but also because the likelihood and the impact of risks cannot be brought to zero, even if the most expensive risk treatment measures are implemented. Also, mitigating risks creates new risks.

Analysis of the WTO Agreements shows that many of the principles declared in them aim at achieving the risk management objective for the management of the trade related risk. The TFA, SPS and Technical Barriers to Trade agreements set out important principles of sound risk management that should be applied by regulatory authorities dealing with safety risks (at borders and in general). These principles include proportionality of regulatory requirements and compliance procedures, systemic risk management, principle of tolerable risk and principle of prioritizing on the basis of risk.

Guidelines for building risk-based regulatory frameworks in support of the SDGs

Building risk-based regulatory systems is a prerequisite for efficient border control, because import compliance is an indispensable part of a market surveillance system – which, in turn, is one of the building blocks of any regulatory framework. For import compliance to be efficient, it should be balanced with other elements of a regulatory framework: criteria for evaluation of non-compliance risks should be based on regulatory objectives, whereas stringency of import inspections should depend on the choice of conformity assessment procedures.

Regulatory frameworks contain requirements for products and services, including those that are traded on international markets. A food safety regulatory framework, for example, contains regulatory requirements for the allowed amount of pesticides in fruits and vegetables, health safety systems of countries establish compliance of medical devices, regulatory frameworks that are not sector specific contain general safety requirements for products. One shipment can be subject to several regulatory frameworks.

UNECE Recommendation R[149] 'Managing risks in regulatory frameworks' presents a regulatory framework as a set of regulatory requirements, conformity assessment and market surveillance procedures. The recommendation sets out a process aimed at ensuring that regulations are proportionate to risks they were set out to address.

UNECE Recommendation T[150] sets out essential steps to build risk-based regulatory frameworks in support of the SDGs. SDGs and targets should be used as inputs when determining regulatory objectives, so the impact on SDGs can be turned into risk evaluation criteria.

Within a risk-based regulatory system, regulations in general and import compliance procedures in particular are results of risk management process, on which a regulatory system is based.

Methodologies to carry out the main steps of the risk management process have been described. Risks in regulatory systems, including those related to non-compliance of products, can be identified on the basis of taxonomies, by generalizing risks of economic operators and by using categorization of impacts, including on SDGs, as well as by other methods. Proactive stakeholder involvement is key in risk identification, as economic operators and other regulatory stakeholders can provide valuable information that regulators might not have otherwise.

Developing a consequence/likelihood matrix is an important tool to evaluate the significance of risks and to rank risks. Risks in regulatory systems simultaneously affect several objectives, and consequences of each risk should be evaluated against every objective, according to established criteria. Defining criteria for evaluating probability is equally important; since tools for evaluating probabilities of risk events differ depending on the availability of data, probability evaluation criteria should be formulated in terms of expert's judgement, frequencies of events, statistical probabilities.

Regulatory authorities can apply any of the available risk treatment strategies. The table below summarizes the interpretation of the risk treatment strategies, as they can be applied within regulatory systems (using the risk 'pesticides in plant products will cause non-acute poisoning' within a food safety regulatory framework as an example):

Table 38 Ways to interpret risk treatment strategies at regulatory level

Risk treatment strategy	Interpretation of the strategy on a regulatory system level	Example
Risk avoidance	Banning activities or processes where the risk can occur.	Banning the import of fruits and vegetables. Banning the use of pesticides in local production.
Sharing the responsibility for managing the risk	Sharing the responsibility for managing the risk, including bearing responsibility if it occurs, to economic or social actors.	Making economic operators responsible for the risk.
Mitigating the risk	Developing a regulatory or non-regulatory response to reduce the probability and the expected impact of a risk. Risks that are above the tolerable level should be addressed by regulatory authority.	Imposing a regulation aimed at controlling the level of pesticides in products.
Tolerating a risk	In a regulatory context, tolerating a risk means that the regulators decide they are unwilling or unable to take measure to reduce the probability and expected impact of a risk.	Preparing a plan for the case the risk occurs.

Source: Valentin Nikonov. Table prepared to illustrate the methodologies described in the guide.

Regulatory requirements, conformity assessment procedures and market surveillance are key building blocks of any regulation. In case regulatory requirements are proportionate to risks they were set out to address, the level of risk associated with regulated products that are compliant with the requirements of relevant regulations is not higher than a tolerable level of risk, whereas each non-compliant product placed on the market poses a risk and requires regulatory response.

The objective of conformity assessment processes is not to allow non-compliant products to be placed on the market. Market surveillance, as a form of post-market control, aims at removing non-compliant products from the market, in case they were produced in spite of existing regulatory requirements and were not prevented from being placed on the market by conformity assessment.

The interrelation of three parameters – stringency of regulatory requirements, levels of risk of a compliant product and level of risk of a non-compliant product – is crucial to set priorities in market surveillance and import compliance. Non-compliant products can also be more or less dangerous. The damage that can be caused by the different non-compliant products will vary depending on many factors, such as safety expectations related to the product and the way it is used.

Checking goods that are placed on the market is the main work of product regulators and market surveillance authorities. As it is not possible or desirable to inspect all products, and given the limited resources of market surveillance authorities, a major challenge regulatory authorities face is prioritizing market surveillance activities: which products, when to inspect them and how to check them. Addressing this challenge requires developing risk-based market surveillance systems that allow:

- Targeting non-compliant products on the market and prioritizing market surveillance activities based on the evaluation of non-compliance risk posed by each product;
- Devising sampling plans that are proportionate to the level of non-compliance risk;
- Choosing adequate sanctions in case non-compliance is identified;
- Promoting the culture of compliance.

Approaches to develop such systems are described in UNECE Recommendation S.[151]

Building such a system requires ranking products against the following parameters:

- Consequences of non-compliance, so that products that are more dangerous when non-compliant (having more severe consequences of non-compliance) are given a higher priority than other products;
- Probability of non-compliance, so products that have a higher probability to be found non-compliant on the market are given higher priority than other products.

It is more efficient to inspect imported products at ports of entrance, as such inspections:

- Minimize consumer exposure to non-compliant products;
- Allow more representative sampling: products are concentrated;
- Are less costly: products arrive to an inspector and not inspector arrives to products;
- In case non-compliance is identified, it is easier to remove products from the market;
- Products can be simultaneously inspected for various non-compliant risks;
- Products are in any case subject to customs controls.

Building a risk-based targeting system in import compliance

Import compliance is the central element of any market surveillance and enforcement system. A risk-based targeting system, in turn, is the central element of any import compliance framework. Successful risk-based targeting allows the regulatory authority to guess correctly about the actual status of incoming shipments before or upon their arrival, so that authority can 'concentrate on high-risk shipments and expedite the release of low-risk shipments', as stated in the WTO TFA.

Any border control agency inspecting imports targets the incoming shipments according to their levels of non-compliance risk, using formal tools or on the basis of inspectors' intuition. Even the extreme cases of import compliance strategies – i.e. regulatory regimes where every incoming shipment undergoes an inspection, or in the opposite case, when every shipment is released without an inspection – are based on risk targeting.

In the first case, every shipment is targeted as a high-risk shipment, while in the second scenario, every shipment is targeted as low-risk. Random inspections are also a form of risk-based targeting. In this case, high-risk shipments are selected using the 'toss a coin' method, with the only difference that generators of random numbers are applied instead of a coin.

Targeting systems assess the non-compliance risk of incoming shipments by comparing the characteristics of each shipment with the risk profiles or compliance rules, based on probability factors and consequences of non-compliance. It allows the regulatory authority to rank incoming shipments according to the level of non-compliance risk and concentrate on those that are high-risk, meaning they have both high consequences of non-compliance (e.g. products in these shipments are dangerous when non-compliant) and a high probability of non-compliance.

Main parameters characterizing an import compliance framework include:

Number of incoming shipments	Total number of shipments within a given period.
Non-compliance rate	Percent of non-compliant shipments.
Inspection rate	Percent of the incoming shipments inspected.
Inspection units	Resources of regulatory authority invested in inspections (man-hours).
Number of inspected non-compliant shipments (targeted as high-risk)	Number of shipments that the system correctly identified as non-compliant. Represents losses, prevented by the targeting system.
Number of inspected compliant shipments (targeted as high-risk)	Shipments that the system identified as non-compliant but that were compliant as the result of an inspection; represents resources that could have been invested in high-risk shipments.
Number of released non-compliant shipments (targeted as low-risk)	Non-compliant shipments that were targeted as low risk and released without inspection (actual number of such shipments is often unknown). Represents losses associated with consequences of non-compliance.

Number of released compliant shipments (targeted as low-risk)	Number of compliant shipments that were correctly classified as low-risk by the system and release without inspection.
Border compliance time	Time that a shipment is held at the border awaiting an inspection, during the inspection and the follow-up.

The import compliance system aims to bring the level of risk to a tolerable level with minimum resources. Risk tolerance constitutes a fundamental input into an import compliance framework and should be proportionate to the available resources and explicitly defined.

Depending on parameters including the compliance rate, it is possible that the tolerable level of risk cannot be achieved with the available resources. In this situation, either risk tolerance or available resources should be increased. The structure of the non-compliance risk is important as it constitutes a basis for profiling the risk of the incoming shipments – that is, assessing the likelihood of non-compliance – and for evaluating the consequences of non-compliance.

Every incoming shipment is evaluated against the rules. As simple as it sounds, this operation requires data processing that would provide the system with all data that are necessary to implement the rules. The final step of the process is risk-based sampling – carrying out an inspection according to the risk evaluation or releasing the shipment without an inspection. If an inspection is performed, it provides evidence on the quality of the prediction provided by the targeting system. In any case, the information on the inspections is added to the history dataset and used to update the compliance rules.

The model shows that a targeting system should be constantly updated. System updates can be categorized as fundamental and operational. Fundamental changes include those related to fundamental inputs to the system. Changes in the risk tolerance of a regulatory authority, as well as in available resources, might require complete rebuilding of the compliance rules and risk profiles, as the updated regulatory regime would need to meet the new requirements in terms of the number of non-compliant shipments whose release without an inspection could be tolerated by the system.

Changes in the structure of the compliance risk – the appearance of new cases of non-compliance or changes in the probability factors – also require rebuilding of the targeting process (at the very least, building and processing new datasets). Fundamental changes should not happen too often. In any case, the system should be reviewed with respect to the required fundamental changes on a system basis.

Operational updates of the system also happen periodically, but more regularly. Such updates allow the targeting system to benefit from the principles of machine learning and include updating the history datasets with the results of the inspections that were performed since the last update.

Risk-based inspections allow resources to be shifted from low-risk shipments to those associated with higher levels of risk. When shipments can be categorized in terms of non-compliance risk, the regulatory authority can assign the following parameters to each risk group:

- Inspection frequency, or inspection rate
- Sample size

Best practice in targeting customs risks

Customs authorities around the world are incorporating risk management strategies into their procedures in the context of achieving their two main goals: ensuring compliance with customs laws and regulations by the efficient control of the cross-border movement of goods, passengers, and transport means; and accelerating economic growth by facilitating foreign trade and investment. Risk management is an efficient and effective technique that stems from progress in science, technology and management innovation.

The rapid growth of international trade limits the opportunity to control every trans-border movement of goods, passengers and transport means, and restricts the inspection of such movements. Therefore, it is imperative that customs authorities introduce risk management strategies and practices into their activities, which requires a more effective approach to the planning and implementation of customs controls. More precisely, it needs to target those controls that have a high probability of detecting infringements.

Risk management targeting techniques rely on current knowledge and innovative methods, based on the application of intelligent IT systems that expedite customs inspections. Before these techniques were introduced, inspection relied heavily on the experience, judgement and insight of customs officers. IT-based intelligent risk

analysis can also improve integrity by avoiding possible discretionary intervention by the customs authority in the selection of shipments to be controlled. This system collects all necessary data for risk analysis, enters these into risk analysis equations and produces results to be used for decision-making.

Modern administrations have progressively developed and implemented predictive approaches to profiling, targeting and inspecting non-compliant declarations to supplement intelligence-based selectivity. This approach is an integral part of modernization programmes for administrations in developing and transition countries. Furthermore, it makes it possible to ensure that most inspection resources are focused on declarations with a high-risk score.

One of the most powerful tools available to customs to reconcile the functions of controlling the international movement of goods with the needs of trade facilitation is represented by data collection and analysis techniques. These techniques are supported by the use of statistics, algorithms and other mathematical tools, as well as by adequate IT systems for their treatment. If properly used, they can allow customs to act in a targeted way to achieve its institutional objectives more efficiently.

Customs authorities can improve the effectiveness of controls and their performance not only by analysing traders' historical activity and the cases of past fraud detected, but also by using additional sources of information, both internal and external to the administration. The reality, however, is that most customs administrations use data analysis almost exclusively for risk management and risk scoring activities.

Instead, a holistic approach suggests that modern customs should use such techniques also to facilitate trade, not only by minimizing obstacles for operators in terms of fluidity of their operations, but by observing and analysing their behavioural patterns to introduce simplifications in customs procedures to make them more user-friendly.

This predictive approach can be combined with customs intelligence to enable the risk management system to incorporate information procured from the intelligence services and to develop indicators for measuring performance, both in terms of efficiency in revenue collection and trade facilitation. With the application and integration of automated systems, customs risk management is becoming more dependent on the in-depth analysis of massive data.

Customs in many countries have implemented big data initiatives. Machine learning from historical data will probably be increasingly helpful for effective risk assessments and accurate targeting decisions. Many customs administrations have explored risk profiling with various data-mining methods, such as clustering, classification, association and statistical scoring.

Data mining allows customs to identify the key risk indicators, summarize the parameters from large databases and increase the accuracy of targeting. Thus, it can incorporate human expertise into machine learning, which can then determine the rules, which would not be able to be detected by human intuition and experience alone.

Data analysis, data warehousing and data-mining techniques, as well as information exchanges, can greatly affect customs' tasks of revenue collection and protection of collective interests. They can enhance customs officials' ability to detect irregular declarations and illegal or suspicious movements of goods, persons and financial flows. Advanced data analytics can enable customs to identify risky transactions and create risk scores in real time, thus facilitating compliant traders while capturing fraudulent shipments.

These techniques, when combined with information exchanges (e.g. with foreign customs administrations and other cross-border regulatory agencies), can maximize performances of customs in the fight against frauds and other illicit activities as a result of more targeted action with minimal impediment to trade.

Addressing the risk of product non-compliance in international trade

Regulatory authorities – product or sector regulators – carry out a remarkable share of border controls to ensure that imported products comply with technical regulations and standards. Technical regulations contain multiple requirements that cover families of different products; inspecting products in many cases requires costly laboratory testing.

Differences between risks of non-compliance with customs regulations and risks of non-compliance with regulations, containing technical requirements for products, explain the main challenges of planning border controls by product regulators. These challenges include:

- **Planning inspections on product level**. Risks of non-compliance should be evaluated on a product level, since different products, even within one family, can have different levels of non-compliance risks.
- **Prioritizing regulatory requirements**. Technical regulations contain multiple requirements; in case a shipment contains a variety of products, regulatory authority can inspect limited number of products with respect to only a limited number of requirements. Choosing which feature of which product against which requirements to inspect is crucial.
- **Knowing the 'non-compliance delta' of each product**. Border controls should be focused on products that have the biggest 'non-compliance delta': the difference between how dangerous a given product is in a compliant and a non-compliant state.
- **Longer inspections.** Establishing conformity with technical regulations and standards require sophisticated, costly and time-consuming conformity assessment procedures, such as laboratory tests.

International best practice in management of risk of product non-compliance described in this report includes New Zealand Risk Engine, US FDA PREDICT, Australia's Compliance-Based Intervention Scheme, the EU's system on food, feed, animal and plant protection, and the EU's regulatory framework on manufactured products.

The process to target non-compliance risk of products includes the following steps:

1. Build a list of products
2. Develop a list of technical factors
3. Rank products according to the consequences of non-compliance
4. Develop probability factors for targeting non-compliance
5. Develop compliance rules and risk profiles
6. Apply compliance rules at the border

Integrating risk management systems of border control agencies

A shipment arriving at the border of any country is associated with a large variety of non-compliance risks. These risks can be broadly categorized as those within the responsibility of the customs authorities – since all imported products are subject to customs regulations – and risks within the responsibility of product regulators, which characteristics depend on the nature of imported products and applicable regulatory requirements.

Integration of risk management systems of individual regulatory authorities into a single framework should cover all processes and elements of a targeting system, from the development of compliance rules to performing inspections. The process for building an integrated framework contains the following steps:

- Integrate inputs to the targeting system
- Build an integrated dataset
- Cooperate in development of compliance rules
- Carry out an integrated evaluation of the targeting system
- Apply compliance rules in an integrated system
- Perform integrated inspections

The chapter provides methodological and technical guidance on implementation of each step of the process.

Integrated identification of non-compliance risks and other key parameters of risk management systems of individual regulators makes it possible to perform a comprehensive analysis of non-compliance risks, risk tolerances and available resources of all border control agencies. It also provides an overview an import compliance system as a whole.

These parameters can be reviewed on a policy level to ensure consistency in the risk tolerance and resources of regulatory agencies involved in border control and their impact on trade facilitation objectives. Creating an integrated dataset means:

- Developing a data model of basic characteristics of a shipment and of a standardized format for data storage;
- Performing correlations analysis between the findings of different regulators and using this information in targeting.

Developing compliance rules that allow targeting high-risk shipments and performing import inspections in such a way that would efficiently allocate the available resources and bring the level of non-compliance risk to the level tolerable by the regulatory authority might be a challenging task that require risk management expertise and IT tools. Cooperation in development of the compliance rules allows for sharing risk management expertise and resources.

An integrated approach implies that every regulatory agency develops compliance rules according to its risk tolerance and available resources. It also calls for centralized shared expertise in risk management. Establishing a targeting centre with risk management professionals that would help regulatory agencies develop compliance rules is an efficient way to allocate the (very often costly) risk management expertise.

In this case, regulatory agencies do not have to hire a full-time risk management professional and or manage IT tools for developing compliance rules. Integrated development of compliance rules also helps ensure consistency in the format in which risk profiles are built and in their storage.

Evaluation of an integrated system based on an integrated dataset results in an overview of what would have happened at the border. Simulating how all regulatory authorities would have performed at the border if they had worked according to the developed compliance rules provides essential information for characterizing the import compliance system as a whole. Importantly, it allows calculating border compliance costs and time for importers and review it in the context of 'overall' residual risk of non-compliance.

To evaluate compliance rules of all regulatory authorities and to simulate how they would have worked at the border requires developing an integrated history dataset that includes all risk factors necessary to apply the compliance rules of all regulatory authorities.

Applying compliance rules, in most cases, requires basic information about the incoming shipment and an information system that can compare the characteristics of the incoming shipment with the conditions of the compliance rules. The integrated approach for import compliance implies:

- Using one source of data on the incoming shipments
- Processing all compliance rules within one information

Finally, integrated assessment of the incoming shipment provides opportunities for regulatory authorities to optimize the inspection time by conducting parallel inspections and delegating an inspection to one authority.

Compliance strategy for business

One of the objectives of risk management is to lower cost of trading for economic operators. Businesses can best take advantage of the opportunity if their internal processes are geared to achieving better compliance with regulatory requirements. Active role of traders can include:

- Invest in cooperation and engagement with border regulatory agencies
- Stay informed of changes and updates in border regulations and procedures
- Demonstrate due diligence in compliance procedures
- Establish pre-compliance processes and a 'reasonable care' checklist
- Apply an internal audit focusing on regulatory compliance
- Invest in training of staff and managers
- Use accredited and authorized operator schemes

Endnotes

1 Risk management as a trade facilitation tool can and should be applied in all border compliance procedures, including export, transit and import. For the purposes of conciseness, an import compliance framework is used throughout this guide as an example of how risk management tools can be applied in border control. All methods and approaches described in the publication can be applied in a similar fashion in export and transit frameworks. Import compliance procedures were chosen as the main focus of this guide due to their higher relevance within a trade facilitation context: in import compliance, a regulatory authority of an importing country evaluates compliance of products arriving from its trading partners (in contrast to export procedures) that will be placed on the importing country's market (in contrast to transit procedures).

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