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Have international trade agreements supported implementation of the Globally Harmonized System of Classification and Labelling of Chemicals?

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The Swedish Chemicals Agency is supervisory authority under the Government. We work in Sweden, the EU and internationally to develop legislation and other incentives to promote good health and improved environment. We monitor compliance of applicable rules on chemical products, pesticides and substances in articles and carry out inspections. We review and authorise pesticides before they can be used. Our environmental quality objective is A Non-toxic Environment.

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Preface

International trade is a key driver of economic growth and can have important implications for the environment. The impact of international trade on the environment is, however, complex. Trade drives economic growth, which is a key element of green growth and sustainable development. Nonetheless, in the absence of environmental policy, economic growth can exacerbate environmental harms when coupled with higher levels of pollution, increased consumption of non-renewable resources and loss of environmental habitats. Trade liberalization can help reduce environmental degradation by expanding access to environmental goods, services and technologies that support more efficient and environmentally friendly production processes. As a result, the liberalization of trade in environmental goods and services has been on the agenda of the World Trade Organization (WTO) since the beginning of the Doha Round (2001). The removal of customs duties and other trade barriers would simplify access to goods and services that prevent or reduce air, water, and soil pollution and so improve the protection of natural resources. Measures to protect the environment and technologies that increase energy and resource efficiency would then become cheaper.

Regional and bilateral free trade agreements can reduce trade barriers and develop provisions to promote green goods and services. Many governments are increasingly recognizing the need to ensure that trade agreements reflect environmental concerns to help achieve overarching environmental goals and to increase their public acceptability. Environmental provisions in regional trade agreements are increasing in terms of their number and variety. These provisions are becoming far-reaching covering issues such as the regulation of hazardous waste, deforestation and the protection of fish stock.

The purpose of this report was to investigate whether environmental provisions in regional trade agreements have been used to promote the implementation of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). Given the extensive global trade in chemicals, and the need to develop national programs to ensure their safe use, transport and disposal, it is recognized that a harmonized approach to classification and labelling would enhance the protection of human health and the environment by providing an internationally comprehensible system for hazard communication. It would also provide a recognized framework for those countries without an existing system, facilitating international trade in chemicals whose hazards have been properly assessed and identified on an international basis, reducing the need for testing and evaluation of chemicals.

We collected 330 free trade agreements signed by about 190 countries from January 2002 to July 2020. By means of computational linguistics, we investigated whether GHS has been mentioned in international trade agreements to date. Interviews with experts and review of the existing literature and data on the status of GHS implementation was used in order to determine if regional cooperation has supported GHS implementation.

This report was written by Associate Professor Jessica Coria under the supervision and guidance of the Swedish Chemical Agency. Sayeh Bagherzadeh supported the data collection and analysis. We are grateful to all the experts that shared their views and knowledge about the use of environmental provisions on international trade agreements and GHS implementation.

Content

Glossary

ANDEAN	The Andean Community Free Trade Area
ANZCERTA	Australia-New Zealand Closer Economic Relations Trade
APEC	The Asia-Pacific Economic Cooperation
ASEAN	The Association of Southeast Asian Nations
CACM	Central American Common Market
CARICOM	Caribbean Community and Common Market
CARIFORUM	CARIFORUM means Caribbean Forum of African, Caribbean and Pacific States
Cefic	The European Chemical Industry Council
CEFTA	Central European Free Trade Agreement
CIS	Commonwealth of Independent States
CUSMA	The Canada-United States-Mexico Agreement
D8	D-8 Organization for Economic Cooperation, also known as Developing-8
EAC	East African Community
EAEU	Eurasian Economic Union
ECO	Economic Cooperation Organization
ECOWAS	Economic Community of West African States
EFTA	European Free Trade Association
EU	European Union
FTA	Free Trade Agreements
GCC	Gulf Cooperation Council
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
ILO	International Labor Organization
IOMC	Inter-Organization Programme for the Sound Management of Chemicals
ISO	International Organization for Standardization
ISO 9000	A set of ISO standards that define, establish, and maintain an effective quality assurance system for manufacturing and service industries
ISO 14000	A set of ISO standards that help companies reducing industrial waste and environmental damage
Mercosur	South American Common Market
OECD	Organization for Economic Co-operation and Development
RTA	Regional Trade Agreements
SAARC	South Asian Association for Regional Cooperation
SACU	Southern African Customs Union
SADC	Southern African Development Community

SDS	Safety Data Sheet
SPS	Sanitary and Phytosanitary Standards
TBT	Technical Barriers to Trade
UN	United Nations
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
UNSCEGHS	United Nations Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals
WSSD	World Summit on Sustainable Development
WTO	World Trade Organization

Sammanfattning

Syftet med denna rapport var att undersöka om miljöbestämmelser i regionala handelsavtal har använts för att främja implementering av det globalt harmoniserade systemet för klassificering och märkning av kemikalier (GHS). För detta ändamål granskade vi 330 frihandelsavtal undertecknade av cirka 190 länder från och januari 2002 tills juli 2020. Med hjälp av beräkningslingvistik undersöker vi om GHS har nämnts i de granskade avtalen. Vår analys indikerar att användningen av ordet ”kemikalier” är ganska vanligt i internationella avtal, som det visas i 159 av de granskade avtalen. Dessutom förekommer ofta ordet ”kemikalier” i samband med jordbruk, avskaffande av tullar, tulltabeller och produktspecifikationer. Däremot har GHS hittills endast nämnts i fyra ganska nya internationella avtal: frihandelsavtalet mellan EU och Japan (gällande sedan februari 2019), avtalet mellan USA, Kanada och Mexiko (gällande sedan juli 2020) och UK avtalet med EU och med Japan som signerades året 2020 i anslutning till BREXIT.

Det faktum att GHS bara har omnämnts i fyra ganska nya internationella handelsavtal verkar spegla det faktum att GHS-implementeringen är ganska ny även i länder som anses ledande inom utvecklingen av miljöregler. Man hänvisar mycket oftare till GHS som anledning till att införa tekniska handelshinder - i enlighet med WTO: s TBT-avtal än i internationella handelsavtal.

Anekdotiska bevis tyder på att strävan att ansluta sig till regionala ekonomiska organisationer och OECD har gett det politiska stöd som krävs för GHS-implementering. Ändå verkar kapacitetsbegränsningar vara den viktigaste faktorn som förklarar klyftan i GHS-implementering. Detta bekräftas av det faktum att det finns en stor variation i GHS-implementering mellan regionala ekonomiska organisationer. Fullt genomförande finner man i ekonomiska organisationer i utvecklade länder och inget genomförande i regioner med kapacitetsbegränsningar.

Summary

The purpose of this report was to investigate whether environmental provisions in regional trade agreements have been used to promote the implementation of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). To that end, we collected 330 free trade agreements signed by about 190 countries from January 2002 to July 2020. By means of computational linguistics, we investigate whether GHS has been mentioned in the agreements collected. Our analysis indicates that the use the word “Chemical” is quite common in international agreements, as it appears in 159 of the agreements analysed. Moreover, such word appears often in the context of chemicals used in agriculture, concerning the elimination of custom duties, tariff schedules and product specifications. In contrast, to date, GHS has only been mentioned in four rather recent international agreements: the EU-Japan free trade agreement (in force since February 2019), the United States –Canada-Mexico agreement (in force since July 2020), and the UK agreements with the EU and with Japan signed in 2020 in connection with BREXIT.

The fact that GHS has only being referred to in four rather recent international trade agreements reflects the fact that GHS implementation is rather recent even in countries deemed as leaders in the development of environmental regulations. GHS has been referred much more often in the notifications to technical barriers to trade – in conformity with the WTO Technical Barriers to Trade (TBT) agreement.

Regarding the role of regional cooperation encouraging and supporting implementation, trade openness and regional cooperation are positively correlated with GHS implementation. Anecdotal evidence also suggests that aspirations to join regional economic organizations and the OECD have provided the political support required for GHS implementation. Nevertheless, regulatory constraints seem to be the major factor explaining the gap in GHS implementation. This is confirmed by the fact that there is a great deal of variation in the rate of GHS implementation across regional economic organizations. Full implementation in 'associations' comprising developed nations, while little or no implementation in economic organizations in regions with capacity constraints.

1 Introduction

Chemical substances and mixtures are essential to everyday life. Some substances have intrinsic hazardous properties that may pose a risk to human health and the environment during production, handling, transport, use, and ultimate disposal. People of all ages, using different languages and alphabets, belonging to various social conditions, are daily exposed to hazardous chemical products.

To face the hazards that chemicals may pose, and considering the extensive global trade in chemicals, an internationally harmonized approach to classify and label chemicals based on their hazardous properties has been adopted by the United Nations (UN). The Globally Harmonized System of Classification and Labelling of Chemicals, GHS, includes criteria for the classification of chemicals by type and severity of hazard and a harmonized approach to communicating hazard information through labelling and safety data sheets. The first edition of GHS was adopted in December 2002 and it has been updated, revised, and improved on a biannual basis. The most recent revised edition (GHS Rev. 8) was adopted in December 2018. The World Summit on Sustainable Development at its meeting in Johannesburg on 4 September 2002 encouraged countries to implement the GHS as soon as possible. However, it is evident that many countries have not done so to date. The lack of legal systems for classification and labelling of chemicals based on GHS seem to have affected implementation in low and middle-income countries, and even in those countries where GHS is implemented, it only applies in some sectors, often only the workplace (see e.g., Persson et al. 2017 and Cefic 2020).

Although GHS is not legally binding, it provides a basis for the harmonization of rules and regulations on chemicals. GHS was developed to consider not only hazards to health and the environment but also to facilitate international trade by promoting a uniform way for hazard assessment and communication. It is therefore of general interest to investigate if and how international trade agreements have been used to promote the implementation of GHS as a tool to provide information on hazardous properties of chemicals. Thus, the aim of this report is to analyze how regional trade agreements and other regional fora have promoted GHS implementation and what types of strategies could help to strengthen the willingness to implement GHS. To this end, the report investigates if free trade agreements within and between trade blocs mention the implementation of GHS in the countries party to the agreement. The report also analyses the state of implementation so far and investigates how regional cooperation has facilitated GHS implementation.

The report covers mostly the free trade agreements signed from January 2002 to July 2020 by the countries belonging to the Association of Southeast Asian Nations (ASEAN), the Asia-Pacific Economic Cooperation (APEC), the Canada-United States-Mexico Agreement (CUSMA), Mercosur, the Andean Community (ANDEAN), the Central American Common Market (CACM), the European Union (EU), the European Free Trade Association (EFTA), The Commonwealth of Independent States (CIS), the Eurasian Economic Union (EAEU), the East African Community (EAC), the Southern African Development Community (SADC), the Economic Community of West African States (ECOWAS) and the Australia–New Zealand Closer Economic Relations Trade Agreement (ANZCERTA).

To identify whether GHS is mentioned in international trade agreements we collected relevant documentation and made use of computational linguistics to identify the presence of keywords in the documents and the use context. For instance, if GHS and other keywords are mentioned, where, and in which terms. Identification of keywords, relevant documentation,

and status and challenges of GHS implementation were also approached through a series of interviews with experts and careful reading of the existing literature.

The report is organized as follows. Section 2 reviews the relevant literature concerning the effects of the adoption of international standards on trade and the use of environmental provisions in international free trade agreements. The report also reviews the existing literature on the status of GHS implementation and the factors explaining the implementation gap. Section 3 presents the methodology used in the report. Section 4 presents the results. Section 5 presents the conclusions while Section 6 discusses the implications of the findings.

2 Previous Research

The Globally Harmonized System of Classification and Labelling of Chemicals, GHS, is a system for classifying and labelling chemicals according to the nature and severity of hazards, specifying how information about hazards should be communicated to users in the form of hazard pictograms, hazard statements, and safety data sheets. Implementing GHS enables those handling chemicals along the value chain to recognize and reduce potential risks by employing best-practice handling, storage, and disposal methods. Thus, the major benefits of GHS implementation are to enhance the protection of human health and the environment by providing an internationally comprehensible system that should facilitate international trade in chemicals whose hazards have been identified on an international basis and provide a recognized framework to develop regulations for those countries without existing systems.

As stated previously, the purpose of this report is to investigate if and how international trade agreements have been used to promote the implementation of GHS. In what follows, we review the existing literature on trade and environmental provisions and the status of GHS implementation.

It is worth mentioning that GHS implementation has many other benefits to governments and firms than increased international trade. For instance, fewer chemical accidents and improved protection of workers and the public from chemical hazards, increased efficiency and reduced costs from compliance with hazard communication regulations, and improved corporate image and credibility, among others. Such benefits are outside the scope of this report but should affect the willingness of countries to implement GHS.

2.1 Has the adoption of international standards enhanced international trade?

Buyers' uncertainty about the quality of products offered for sale hinders international trade. Spatial, cultural, and linguistic barriers in international commerce accentuate buyers' difficulties in discerning product quality. Developing country exporters face greater challenges than the exporters from developed countries in credibly signaling product quality because international buyers tend to infer product quality from the reputations of products' country of origin (see e.g., Potoski and Prakash 2009). International standards can promote international trade through different channels. They can lead to increased trade because they reduce the buyers' uncertainty about the quality of products. By providing information and a form of quality insurance, they also reduce trade costs through reduced search costs and possibly quality control costs. This is expected to facilitate both the trading relationships that already exist (i.e., intensive margin) as well as the development of new trading relationship among countries that have not traded with each other in the past (i.e., extensive margin).

Nonetheless, international standards can also affect the international competitiveness of small-scale producers, particularly in developing countries. If producers in developing countries are competing directly with producers in developed countries, and are in general less able to implement the requirements imposed by international standards at a given level of cost, they could lose out from exported markets.

Developing countries with fragile governance structures do not have any entities capable to implement international standards. Nevertheless, over time, international standards might help to reduce the institutional and development gaps between trade partners, particularly in the

case of third-party audited standards where the standards can act as surrogate governance institutions (see Fiankor et. 2019).

Empirical evidence on the effects of international standardization on trade is scarce. The available studies are few in number and focused on very few standards and products (see e.g., Elamin and Fernandez de Cordoba, 2020). For instance, empirical studies examining the implications of food safety and quality standards on trade between developing and developed countries are mainly confined to public standards or codified quality management systems such as ISO 9000 and ISO 14000 (Elamin and Fernandez de Cordoba, 2020). A mapping of the findings from such studies shows that there is often a positive relationship between international standards and exports or imports, which is in line with the widely held view that international standards are supportive of trade (Swann 2010). Assessing the comparability of results from different studies is though a challenge since the different studies refer to different countries, different industries, and different measures of standards.

Empirical evidence confirms though that third-party audited standards (i.e., certification) are a catalyst to trade (see e.g., Henson et al. 2011 and Fiankor et. 2020). However, the trade-enhancing effect varies across products and destination markets and it seems to be driven by an increase in the intensive rather than extensive margin (increase in trade by certified producers rather than by newly certified producers). In particular, firms that achieve certification have appreciably higher export revenues than it would otherwise have been (see e.g., Henson et al. 2011). For example. Grajek (2004) studies the effects of ISO 9000 on bilateral trade flows among countries using data on 101 countries over the period 1995-2001. He finds that ISO 9000 certified firms tend to trade with each other more than with uncertified firms. Consequently, the positive impact of these standards on trade is more pronounced among ISO 9000 abundant countries.

Regarding the timing of adoption, the developed countries in Europe were among the first to adopt ISO standards and in turn influenced other countries. Studies on the pattern of international diffusion of ISO 9000 and ISO 14000 certification seem to agree that developed countries have entered the mature stage, while the diffusion in developing countries is in its infancy and still needs further investigation (Sartor et al. 2019). If the diffusion of certification in the less developed countries is sluggish – e.g. due to weak institutional framework – the benefits of certification might stay in the developed countries' domain. Technical and financial assistance for standards implementation seems thus essential to support exporters from developing countries. Otherwise, the high compliance costs can lead to exclusion from exported markets.

Certification has also been shown to have a positive effect on bridging institutional gaps between trading partners (see e.g., Fiankor et. al 2019). Undoubtedly, certification in itself is not enough to overcome the total bilateral institutional gaps among countries. Nevertheless, being certified to a standard that is accepted in the importing country can help producers located in countries with low quality of existing domestic institutions to overcome the negative reputation effects associated with their geographical locations. Thus, it is a viable alternative to reduce trade costs and enhance trade.

Harmonization is the process of minimizing redundant or conflicting standards that may have evolved independently. Harmonization of international standards can further reduce barriers to trade by enabling a freer movement of products among countries. Regarding the effects of international harmonization of regulations and standards, Vancauteren and Weiserbs (2005) and Henry de Frahan and Vancauteren (2006) analyze the effects of EU harmonization of technical regulations. To this end, they construct a trade-weighted coverage variable that

measures the proportion of a country's exports that satisfies the EU's harmonization of regulations. Using data on intra-EU trade for the period 1990-1998, they find that harmonization of EU regulations has played a strongly positive and statistically significant role in explaining the growth of intra-EU trade in manufacturing and food products, respectively.

The evidence described above points to international standardization and harmonization enhancing international trade. Nevertheless, the reverse also holds as international trade has been identified as a key factor in the diffusion of international standards (see e.g., Liu et al. 2020). For instance, the adoption of ISO 9000 in China was initially largely fueled by trade-related pressures. This is to be expected, given that China has become one of the main suppliers of firms in developed countries and downstream pressures are likely to occur (see e.g., Albuquerque et al. 2007). The drivers of adoption seem, however, to differ depending on the type of standard. Standards with more narrowly business-related objectives, such as quality management, accounting principles, or software standards seem to diffuse more along supply chains and hence bilateral trade relationships. In contrast, standards that focus on "societal" issues such as the environment, labor standards, corporate social responsibility, etc., seem to experience more culturally driven diffusion and follow geographic proximity (Albuquerque et al. 2007).

2.2 International Standards and the TBT agreement

The multilateral negotiations under the World Trade Organization (WTO) have successfully liberalized trade, especially with the large scale and widespread tariff reductions. However, non-tariff barriers have arisen to substitute the traditional trade protection, namely tariffs (Ronen 2017). Among various forms of non-tariff barriers, the so-called technical barriers to trade (TBT) have become more and more important (Bao and Qiu 2012). TBT are introduced for a range of reasons. For example, environmental protection, safety, national security and consumer information. They vary from country to country in terms of their magnitude and product coverage. The WTO's TBT Agreement tries to ensure that the imposed standards and technical regulations do not create unnecessary obstacles to trade.

The TBT Agreement strongly encourages members to use relevant international standards, guides, or recommendations as a basis for their regulations and standards. An exception to this is the case when such international standards or relevant parts would be an ineffective or inappropriate means for the fulfillment of the legitimate objectives pursued (e.g., because of fundamental climatic or geographical factors or fundamental technological problems, see Articles 2.4, 5.4 and Annex 3, paragraph F of the TBT Agreement). The Agreement also recognizes that developing country members should not be expected to use international standards that are not appropriate to their development, financial and trade needs (Article 12.4 of the TBT Agreement).

The TBT Agreement promotes the use of international standards to reduce the costs of product adaptation and conformity assessment that arise when technical requirements vary from market to market. Such costs can segment markets, hindering competition, and reducing international trade. International standards can help countries overcome these problems by ensuring compatibility across countries and conveying information to consumers about goods that have been produced abroad or processes that took place in another country. Furthermore, because international standards codify the related scientific and technical knowledge developed at the global level, their development and use are important means of disseminating knowledge and fostering innovation.

Governments are required to notify other members, through the WTO Secretariat, of proposed measures that may have a significant effect on other members' trade and that are not based on relevant international standards. Notifications reveal how members intend to regulate to achieve specific policy objectives and what might be the trade implications of their regulations. Receiving information about new regulations or standards at an early stage, before they are finalized and adopted, gives trading partners an opportunity to provide comments either bilaterally or in the TBT Committee, and to receive feedback from the industry. For the sake of greater transparency, some members choose to notify draft measures even when they are in accordance with relevant international standards, guides or recommendation. This is also a practice that is encouraged by the TBT Committee, which has, over the years, adopted a series of guidelines and recommendations related to the practical implementation of transparency requirements.

Notifications of technical barriers to trade might raise the costs levied on foreign exporters who want to sell their goods to the country implementing a standard. Thus, they are expected to reduce both the export extensive margin (i.e. the number of exporting countries) and the intensive margin (i.e. the export volume or value of each exporting country). However, TBT also informs the consumers that the imported products have met specific standards (health, safety, and others) and fulfill the regulations, which promotes imports because consumers become more confident about the products. Thus, TBT might help correct a market failure due to incomplete information. This information-revealing aspect of TBT might raise consumers' demand, thereby raising both the extensive and intensive margins.

How trade is affected by TBT notifications becomes therefore an empirical question since the net effect depends on the relative magnitude of effects described above (i.e., increased production costs versus increased demand due to increased information). Furthermore, the effects of TBT notifications might differ between developing and developed countries since consumers in developed countries may be in a position to factor in concerns about the quality of the products, while consumers from developing countries may be more sensitive to prices. Moreover, producers from developed countries may have better technologies and resources to adjust their products to meet the new TBT from the importing countries than producers from developing countries. Products from developed countries may already meet the new standards imposed by importing countries and thus are not affected.

Bao and Qiu (2012) investigate the effect of all TBT notifications from 105 countries during the period 1995–2008. They find that TBT notifications reduce the export extensive margins, but raise the export intensive margins. It was further found that a developing country's TBT have significant effects on other developing countries' exports, but no significant effects on the developed countries' exports. In contrast, a developed country's TBT have significant effects on the exports from both types of countries. A potential explanation to the results above is that TBT raise the costs of the developing countries' exporters more than the raise on the costs of developed countries. This may be an indication that producers from developed countries already produce the standards of the TBT and therefore the costs for upgrading them is not high, while it can take a lot more effort for the producers from developing countries to bring their products up to the standard. Since developing countries' technical standards are relatively lower than the developed countries, TBT imposed by a developing country might influence other developing countries but not the developed countries. TBT and sanitary and phyto-sanitary measures (SPS) might also have a larger impact on developing countries since they affect traditional sectors, such as agriculture and food, textile, garment, iron and steel, which are often at the heart of the export activity of developing countries (Eyal 2017).

Overall, the literature describing the effects of TBT and SPS notifications on trade point to increased trade volumes though implementation costs would have to be faced by developing countries in the short run. This is consistent with the evidence of the effects of codified quality management systems (i.e., ISO standards). The question is then how can the costs of standard implementation be reduced to facilitate adoption by low and middle-income countries.

2.3 Environmental provisions in international trade agreements

The last 25 years have witnessed a rapid increase in regional trade agreements (RTAs). Moreover, an increasing number of trade agreements have extended their scope to cover specific policy areas such as environmental protection and sustainable development. This emerging trend in the increased frequency of environmental provisions in RTAs implies an increasing recognition of the interaction between trade and environmental aspects, and the mutual supportiveness of the two areas. It also suggests a new way of thinking about more effective ways to achieve trade and environment policy objectives.

George (2014) suggests that an important factor contributing to the increased frequency of environmental provisions is that example countries (such as the United States and the European Union) have both extended their political mandates for the RTAs in which they are involved, to include provisions for compliance with multilateral environmental agreements, leading other countries to follow in their path. For example, the legal mandate for inclusion of environmental provisions in the EU's RTAs is provided in the EU Treaty (Official Journal of the EU, 2012) which defines sustainable development as an overarching principle that guides the EU internal and external action. In addition, Article 11 of the EU Treaty explicitly states that environmental protection requirements must be integrated into the definition and implementation of EU policies and activities, in particular with a view to promoting sustainable development (see George 2014).

OECD and the WTO have published in-depth studies on the implementation of environmental provisions in RTAs (see e.g., George 2014, Monteiro 2016, George and Yamaguchi 2018, and Martínez-Zarzoso 2018). Three major aspects covered by such studies include:

1) Establishing a typology of environmental provisions in the agreements. In particular, where in the agreements are environmental provisions found, how common they are, and what form they take.

2) Understanding of the drivers of implementation.

3) Determining the effectiveness of environmental provisions on actual environmental performance.

Such studies highlight that important drivers of implementation of environmental provisions are the intention to promote awareness of environmental laws, regulations and policies, to signal prioritization and importance of environmental matters, and to ensure that environmental standards are not used as trade barriers by ensuring a level playing field among Parties to the agreement. All such motivations involve economic as well as environmental considerations. As discussed by George (2014) the concept of 'levelling the playing field' is addressed in RTAs in several ways: through cooperation on environmental matters of shared interest often to build capacity to deal with environmental issues; through nondiscrimination provisions; through non-derogation provisions obliging parties to a trade agreement to effectively enforce their environmental laws; and through provisions encouraging high levels of environmental protection. Upholding environmental law between trading partners is a clear

way to avoid the relocation of pollution intensive industries, i.e., the so-called the “pollution haven hypothesis”.

Regarding the typology of environmental agreements, Monteiro (2016) identifies four different types of RTAs with environment-related provisions, namely:

(1) RTAs with only non-specific environment-related provisions. Nonspecific environment-related provisions include preamble language; provisions in the chapters on TBT and SPS measures; and exceptions and exclusions clauses.

(2) RTAs with only specific environment-related provisions on cooperation. The provisions on environmental cooperation activities often constitute means to facilitate the implementation of the RTA's environment-related provisions and address specific environmental challenges identified by the parties, such as water management and air pollution.

(3) RTAs with only substantive specific environment-related provisions. These trade agreements establish commitments with respect to domestic environmental laws, including the commitment to effectively enforce them and not weaken them to attract trade and investment.

(4) RTAs with substantive specific environment-related provisions and provisions on environmental cooperation. These RTAs typically include detailed provisions related to domestic environmental laws and multilateral environmental agreements.

The aim of enhancing co-operation in environmental matters has been identified as one of the primary reasons for including environmental provisions in RTAs. Some RTAs set out broad arrangements for environmental co-operation with few specific details. Others establish a commitment in greater depth by establishing a specific mechanism for implementing co-operation activities. In some cases, these activities are defined within the trade agreement itself, or in an associated co-operation agreement, and in others, the implementation body is made responsible for defining them.

Monteiro (2016) reports that 56% of 270 RTAs analyzed in his study (i.e., 153 agreements) incorporated specific environmental provisions. Environmental issues that were fairly common in those RTAs included promotion of trade in environmental goods and services; renewable energy; energy conservation; climate change; biodiversity; control of invasive species; air quality; water quality; soil quality; marine pollution; water resources; fisheries resources; forest resources; illegal timber; and desertification.

Out of the RTAs incorporating specific environmental provisions, 26% included specific environment-related provisions on cooperation, 22% included substantive specific environment-related provisions, and 52% of the RTAs included both cooperation and substantive specific environment-related provisions. Furthermore, most RTAs incorporating a high number of specific environment-related provisions established also specific institutional arrangements, such as environmental committee, in order to discuss and oversee the implementation of some of the environment-related commitments. Many RTAs provided also consultations procedures for any environment-related matter arising under the RTA's environment chapter and/or side environmental agreements. Only a limited number of RTAs provided with specific dispute settlement procedures established under the RTA's environment chapter or environmental side agreement. Conversely, several RTAs explicitly exclude the environment chapter from the RTA's dispute settlement chapter.

Adopting environmental provisions in RTAs is an important step towards promoting environmental protection on an international scale. Nevertheless, the success of such

measures depends on how governments implement the environmental provisions contained within their trade agreements. George and Yamaguchi (2018) assess the progress of the implementation of environmental provisions in RTAs by analyzing the extent to which governments have complied with the environmental commitments made in the trade agreements to which they are a Party. Unfortunately, their analysis reveals a considerable lack of knowledge on the implementation of environmental provisions in RTAs. Only 18 out of 177 RTAs with substantive environmental provisions had documentation in terms of implementation records and evaluation reports. Nevertheless, the results highlight that good progress has been made in implementing environmental provisions in some RTAs. For instance, the United States and the European Union have made significant steps towards setting what may be regarded as a benchmark for monitoring and reporting on the implementation of environmental provisions in RTAs. George and Yamaguchi (2018) also highlight that all countries that promote the inclusion of environmental provisions in RTAs could benefit from strengthening their processes of monitoring, reporting and review as far as they reasonably can.

Environmental provisions in RTAs may have positive environmental effects through channels such as strengthening national environmental regulations, introducing new institutional arrangements, promoting environmental co-operation and improving environmental awareness (see Martínez-Zarzoso 2018). However, assessing the effectiveness of environmental provisions in regional trade agreements is a challenging task due to potential reverse causality in the statistical analysis performed. In particular, RTAs, trade openness and income levels may all affect the level of environmental quality of a country, but the level of environmental quality also affects income, trade, or the signing of an RTA, leading to reverse causality. The empirical challenge is to separate out the effect of the RTA and its environmental provisions from other drivers of environmental policy at the country level.

The literature on the environmental effects of including environmental provisions in RTAs is scarce. One of the few studies available is the one by Martínez-Zarzoso (2018), who addresses potential endogeneity of the RTA variables by means of econometric methods. She investigates whether participation in RTAs with environmental provisions affects environmental quality, and whether the inclusion of more comprehensive environmental provisions has a stronger effect on environmental quality. The analysis is done considering the RTAs that entered into force or were enlarged over the period 1970 to 2011, out of which 94 included environmental provisions. She proxies environmental quality by means of air quality indicators including the concentrations of particulate matter, sulfur dioxide and nitrogen oxides. She finds that environmental provisions may have a positive effect on the environment, however, these effects could not be demonstrated with sufficient statistical certainty under the available data. Thus, the anticipated hypothesis that including environmental provisions in RTAs will encourage members to apply stringent environmental regulations and reduce environmental damage needs to be further examined.

Finally, it is worth mentioning that the recent study by Brandi et al (2020) investigates the effects of environmental provisions in trade flows of developing countries. They show that environmental provisions can help reduce dirty exports and increase green exports from developing countries. Moreover, this effect is particularly pronounced in developing countries with stringent environmental regulations. Such developing countries seem to be better positioned to green their exports in response to environmental provisions in trade agreements than other developing countries. This, in turn, offers support to those that call for adopting green policies straight away (‘‘greening now”) rather than a ‘‘grow first, cleaning up later” strategy for latecomer economies (see e.g., Pegels and Altenburg, 2020). Environmental

provisions in RTAs can complement environmental reforms at the country level but they cannot be a substitute for them.

2.4 GHS Implementation and the Implementation Gap

Although the need for an internationally harmonized system was first formally recognized at the United Nations (UN) in 1992 in Agenda 21, it wasn't until ten years later, in 2002, at the World Summit on Sustainable Development (WSSD), that UN member states decided to; "[e]ncourage countries to implement the new globally harmonized system for the classification and labelling of chemicals as soon as possible with a view to having the system fully operational by 2008." Although significant progress has been made to adopt GHS around the globe, as of this writing it has still not been implemented in 118 countries.

What does GHS implementation necessitate and why GHS has not yet been widely implemented around the world? Regarding the first question, Jonai (2008) points out that major activities required for GHS implementation are the translation of GHS documents to the national language, information sharing among ministries to identify gaps between the GHS and existing national laws, and the actual classification of chemicals by experts from laboratories and the industry. Once substance have been classified (e.g., substance X is found to be toxic or flammable), their hazards need to be communicated to target audiences. The main tools of chemical hazard communication are labels and safety data sheets (SDS). These tools contain hazard information in the form of hazard pictograms, signal words and other communication elements.

In addition to providing labels and SDS, a number of supportive measures need to be considered and implemented to ensure the success of an effective chemical hazard communication system. For example, training all target audiences to recognize and interpret label and/or SDS information, and to take appropriate action in response to chemical hazards. Key target audiences include emergency responders, those using chemicals in the workplace, involved in label and SDS preparation, and the transport and supply of hazardous chemicals and the general public. Consequently, training requirements for producers and users differs (Ta et al. 2009).

Countries without existing regulations are expected to adopt GHS as their basic scheme. Although the GHS would help them in developing a comprehensive chemicals management strategy, many challenges exist in creating new regulations. As for instance, the appropriate legal framework for adopting/implementing the GHS, the ministries and government agencies that should be involved to implement and maintain the GHS, and ensuring the availability of support to stakeholders for implementing the GHS.

In the case of Japan –the first country to adopt the GHS- an inter-ministerial committee consisting of policymakers, GHS experts and industrial representatives was organized to oversee GHS implementation. GHS classification manuals and technical guidance were provided to facilitate classification. Thus, industry got easy access to data sources that were reliable for the classification of hazards that had been rated for their quality and relevance. GHS implementation also required a nationwide public campaign to increase awareness on the GHS. To that end, several ministries and organizations developed a package of information, education and communication materials, and many training courses on chemical management and seminars and workshops focusing on chemical classification were conducted.

Regarding the implementation gap, Persson et al. (2017) provide a global overview of current GHS implementation status and explain differences between countries. Their overview is

consistent with significant regional differences in GHS implementation coverage. Moreover, financial and regulatory capacity stand out as key factors associated with GHS implementation. Other factors explaining implementation were the commitment to international collaboration and to occupational health and safety, and the degree of trade openness. Anecdotal evidence also seems to indicate that aspirations to join a community may also be an important driver by providing the political support required for GHS implementation. For instance, Albania, Georgia, and Bosnia and Herzegovina are European countries with aspiration to increase collaboration with the European Union. Since GHS implementation is part of a legislative alignment, it has been an important factor behind GHS implementation in those countries. Another example is provided by Armenia, Kazakhstan, Belarus and the Kyrgyz Republic that have decided to introduce joint legislation implementing GHS as part of the collaboration within the Eurasian Economic Union, see Persson et al. (2017).

Regarding the African region, Persson et al. (2017) highlight the role of sustained capacity building and donor support. The need for capacity building and awareness raising for successful GHS implementation in low-income countries has been long standing on the agenda of international collaboration. However, the type of capacity building is place has not been sufficient to render support to a country to follow through to actual GHS implementation in legislation. A clearer focus on integrating GHS into an overarching chemical management for the country, building national capacity that can be sustained also after the project is finalized, follow-up mechanisms of specific targets to reach in the years after project completion, and increased attention to long term financing of activities have been suggested as strategies that could support implementation in developing countries.

The lack of following up mechanisms has been indeed regarded as an important constraint to implementation. Particularly, since there are not clear or unique definitions of what constitutes “GHS implementation”. According to Peterson et al. (2010), one useful approach is to consider the implementation process as comprising two parts: policies and actions. A strategic approach to GHS implementation involves thus the development and coordination of both components. National policies for addressing the GHS are a core requirement for effective implementation. Policies will depend on national circumstances, but should specify the functions of regulatory agencies and the extent of implementation across sectors. A variety of actions is available when planning implementation of GHS at the national level. For instance, awareness raising, the development of guidance and capacity-building materials, information and knowledge sharing of internationally assessed hazardous chemicals, and risk management. Unfortunately, indicators and indices for GHS implementation are not published to date, which makes it difficult to evaluate the effectiveness and quality of implementation. Moreover, countries are not required either to report on the status of progress at no point in the process. UNITAR and ILO, in collaboration with UNECE, track legal implementation as an IOMC indicator of progress. Moreover, the Secretariat of the United Nations Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals (UNSCEGHS) has published available information in relation to the implementation of the GHS, but the data (used by Persson et al. 2017) is partial and incomplete, given the lack of a need to report on implementation steps. Additional efforts to collect information have been done by the European Chemical Industry Council (Cefic). Both UNSCEGHS and Cefic have collected information as a response to requests from the industry, who wants to know what standards apply in different countries. Cefic has also collected information to provide some perspectives and examples that may be useful to countries that have not yet adopted GHS.

A final concern regarding implementation is whether GHS will guarantee improved uniformity of chemical classification and hazard communication worldwide. Such concern is raised since at present there is no guidance nor implementation mechanism adopted internationally to establish a list of classified chemicals in accordance with the GHS (Yazid et al. 2020). Since existing laws and regulations concerning hazard communication were independently developed by each country, the way in which decisions on the provisions of the GHS integrated into new laws and regulations vary among countries. Moreover, some countries have developed their own lists of classified chemicals in accordance with the GHS to "standardize" the classification results within their respective countries. However, as these lists are developed by individual countries, there are also inconsistencies among them. Thus, there is a risk that inconsistencies in hazard communication might lead to confusion among chemical users on the proper protection required when using and handling those chemicals. The benefit of having a single, internationally consistent system for chemical classification, labelling and hazard communication may therefore remain elusive.

3 Methodology

Our methodological approach makes use of computational linguistics, interviews with experts and a review of the existing literature and data in order to determine whether GHS has been mentioned in international trade agreements to date and if regional cooperation has supported GHS implementation.

Computational linguistics is concerned with understanding written and spoken language from a computational perspective. Through text mining, we are able to identify the presence of keywords in documents and the context of use. Identification of key words, relevant documentation and status and challenges of GHS implementation were also approached through a series of interviews with experts and careful reading of the existing literature. See Appendix A for a list of the experts interviewed.

3.1 Collection of data on international treaties

To construct a sample of countries relevant to our study, we started with the countries belonging to fourteen major regional associations, namely, the Association of Southeast Asian Nations (ASEAN), the Asia-Pacific Economic Cooperation (APEC), the Canada-United States-Mexico Agreement (CUSMA), Mercosur, the Andean Community (ANDEAN), the Central American Common Market (CACM), the European Union (EU), the European Free Trade Association (EFTA), the Commonwealth of Independent States (CIS), the Eurasian Economic Union (EAEU), the East African Community (EAC), the Southern African Development Community (SADC), the Economic Community of West African States (ECOWAS) and the Australia–New Zealand Closer Economic Relations Trade Agreement (ANZCERTA).

In total, 112 countries belong to such associations. Thus, we collected initially a database consisting of all available international free trade agreements signed from January 2002 up to July 2020 by these 112 countries. However, since some of these countries have signed agreements with countries not covered by such associations, the number of countries in our sample increased to 190. An overview is provided in Figure 1.

To find the trade agreements, we searched for the information available for the countries one by one, by searching through official government portals and related ministries' website, such as the Ministry of Industry, the Ministry of Commerce, and the Ministry of Foreign Affairs. Unfortunately, available information on the web for less developed countries – particularly African countries - and their possible agreements is very scarce. A potential explanation to this is that they may not use web portals to publish their agreements. So searching for them on the internet did not lead to a significant result. Thus, the search was complemented by a search in international portals (e.g., WTO) and the portals of regional associations.

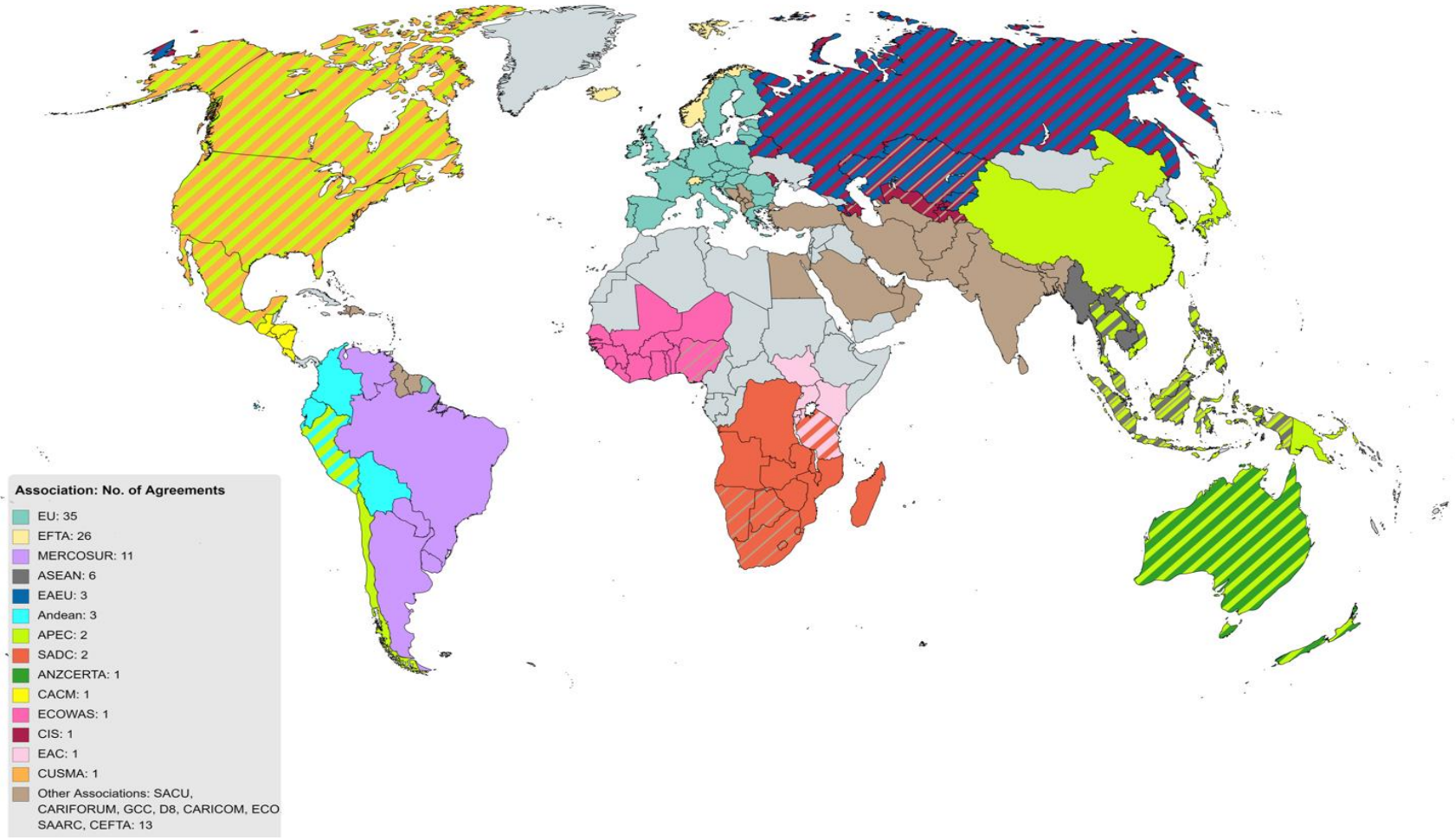
Thus, the final database consisted of 330 international agreements among about 190 countries around the world. The complete list is available upon request. It is worth noting that the collected agreements are mostly about trade in goods. We did not collect agreements concerning trade in services agreements, investment agreements, framework agreements, and memorandum agreements, as they seemed less relevant to our project. Nonetheless, this could be an area of interest for future work, as responsible consumption and production practices take off. For example, UNIDO promotes chemical leasing whereby a product is not sold (e.g. a volume of paint) but a service is provided (e.g. a building is painted), and thus sound

management of chemicals may be of chemicals may become part of service-based agreements, rather than just goods.

Some agreements from the early 2000s were only available as very low-quality photos or scanned images from paper versions, while the most recent agreements were available as PDF files created from electronic versions. The methods of accessing these two types of documents were different. The files were reviewed one by one and separated from each other, and then a sample file was taken from each category. Since we have different methods for converting PDFs to text, as well as different methods for doing optical character recognition, all such methods were applied to the two sample files. By doing this, we were able to compare the accuracy of these methods with each other and select the best ones with the highest accuracy of word recognition for each of the two categories. Then we started converting scanned and electronic pdf files to text files. This enabled us to go through the text of agreements and make use of text mining. We employed a bag-of-words method so the first step was to create a set of related keywords (hereinafter "GHS-specific dictionary", or just "the dictionary" in brief).

Through interviews and communications with experts in the field we created a dictionary containing 55 words (List 1), including uni-grams (one word), bi-grams (two words), and multi-grams (more than two words) that are commonly used in environmental provisions in international trade agreements. Since there are about 50 non-English agreements (mostly Spanish), we repeated the above process to create a Spanish GHS-specific dictionary.

Figur 1. Overview of the economic associations covered in this report and their member states plus the number of international trade agreements signed in these associations since 2002.



List 1. GHS-specific dictionary (English version)

- Globally harmonized system of classification and labelling of chemicals
- Globally harmonized system
- Classification and labelling
- classification, labelling
- UNSCEGHS
- (GHS)
- GHS label
- Classification system
- Labelling system
- Hazardous chemicals
- Dangerous chemicals
- Transport of chemicals
- Labelling of chemical
- Classification of chemical
- Chemical substances and mixtures
- International chemical regulation
- (CLP)
- CLP regulation
- Sound
- Workplace safety
- Occupational safety
- Occupational health
- Health
- Minamata Convention
- ILO Convention 170
- Toxic
- Pesticides
- Circular economy
- Chemical management
- Health and environmental chemical safety
- Chemical Safety
- Animal
- Article XIV GATS
- Article XX GATT
- Article 27 of the Agreement on trade-related aspects of intellectual property rights (TRIPS)
- Basel Convention
- Biological diversity
- Chemical
- Climate
- Ecology
- Endangered Species
- Energy
- Environment
- Fauna
- Flora

- Montreal Protocol
- Natural resources
- Ozone
- Plant
- Pollution
- Renewable
- Rotterdam Convention
- Stockholm Convention
- Sustainable
- Waste
- Wildlife

After language identification, we employed Python codes to search n-grams of dictionaries in the text of agreements. Therefore, the frequency of each keyword in the whole dataset was determined, as well as the sentences in which that keyword was mentioned. As described in Section 3, environmental provisions might be addressed in specific sections of the agreement. Identifying the sections in the agreements where the keywords are mentioned was challenging since different agreements do not follow the uniform structure in terms of writing format (e.g. some have sections, some have chapters, and some only contain sequential articles). To overcome this challenge, we made use of text processing and search patterns (regex) instead of just searching for exact terms.

3.2 Data on notifications to TBT and SPS

As mentioned previously, WTO Members are required to notify other members of proposed measures that may have a significant effect on other members' trade and that are not based on relevant international standards, providing an opportunity for other members to comment on these measures. They might also voluntarily notify draft measures even when they are in accordance with relevant international standard for the sake of transparency. They do so by submitting a two-page info sheet on the regulation with information on products covered, a brief summary of the regulation and the deadline for providing comments. These info sheets, called SPS or TBT notifications, are available to interested users on the web portal ePing. We utilized the web portal ePing to search for references to GHS in the TBT and SPS notifications.

3.3 Data on implementation Status

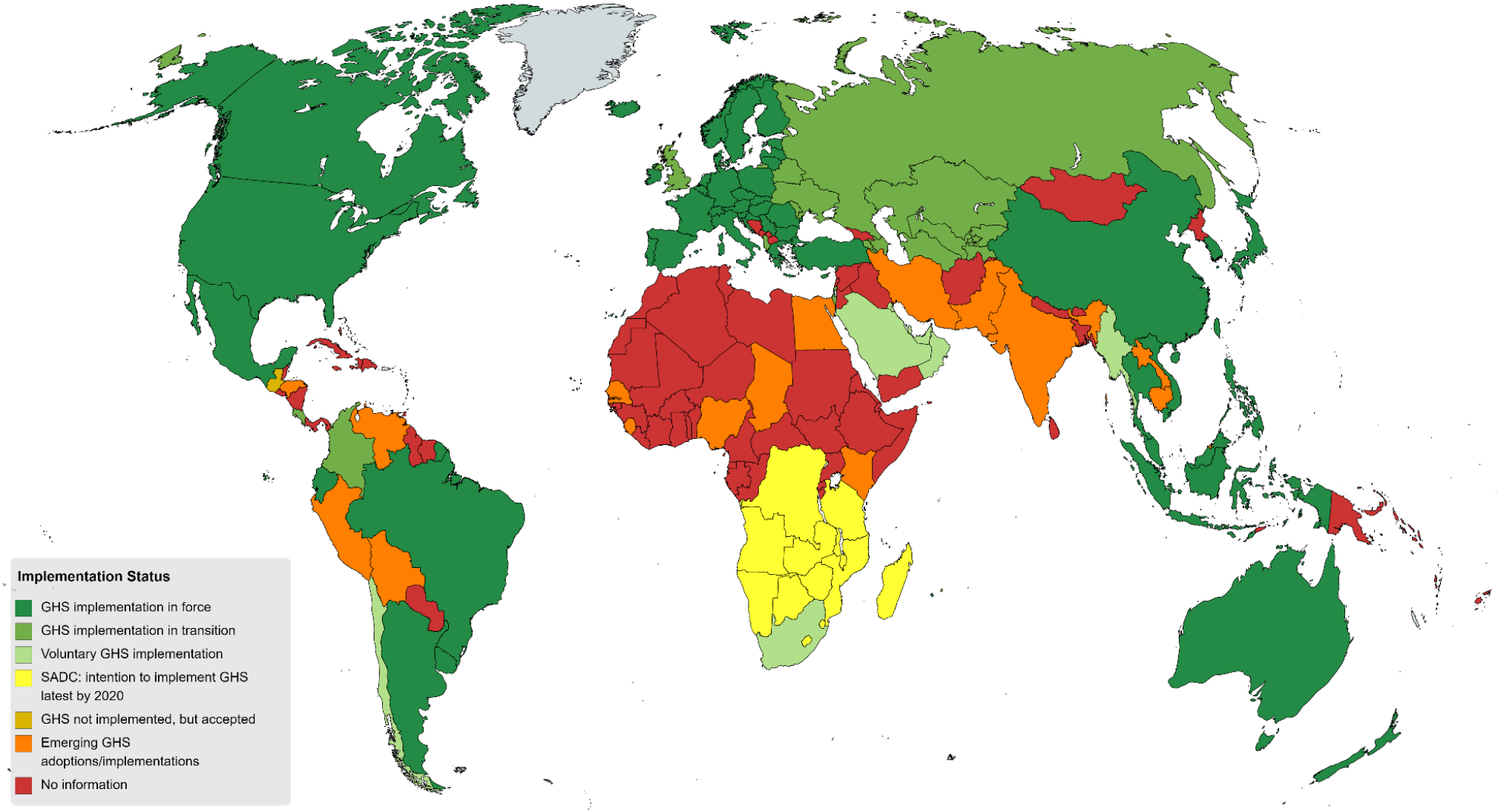
In order to organize and integrate all available information on the latest status of countries' GHS implementation, we created a database containing various variables and indicators for 197 countries around the world. Various sources were used to collect data for this database, but one of the main ones was a report published by The European Chemical Industry Council (Cefic) in January 2020.

Variables related to the status of GHS implementation in the database were mostly added based on the Cefic report (2020) and the progress reports compiled by the secretariat of the GHS Sub-committee. We also used a document updating the latest status of GHS implementation in Latin America (Cuevas 2019). In addition, when facing missing values for some implementation variables about some countries, we made use of the webpage ChemSafetyPRO, where a group of chemical regulatory experts provides summaries of the latest GHS implementation in some countries. We also collected information on the status of implementation in the transport sector, which is presented in Appendix B.

The map in Figure 2 represents the current state of GHS implementation. In 52 countries, GHS is implemented and in force (26.3%), in 17 countries (8.6%) GHS implementation is in transition, 10 countries (5%) have implemented GHS voluntarily, 14 countries (7.1%) have the intention to implement GHS latest by 2020, one country (0.5%) has not implemented GHS but accepted it, in 17 countries (8.6%) GHS adoptions/implementations are emerging, and for 86 countries (43.6%) there is no information about implementation status. It can be noted that GHS has mainly been implemented in major economies whereas the countries especially in Africa have not implemented GHS or that information is lacking.

Figure 2. GHS Implementation Status in the World.

Source: Cefic (2020), Cuevas (2019) and ChemSafetyPRO



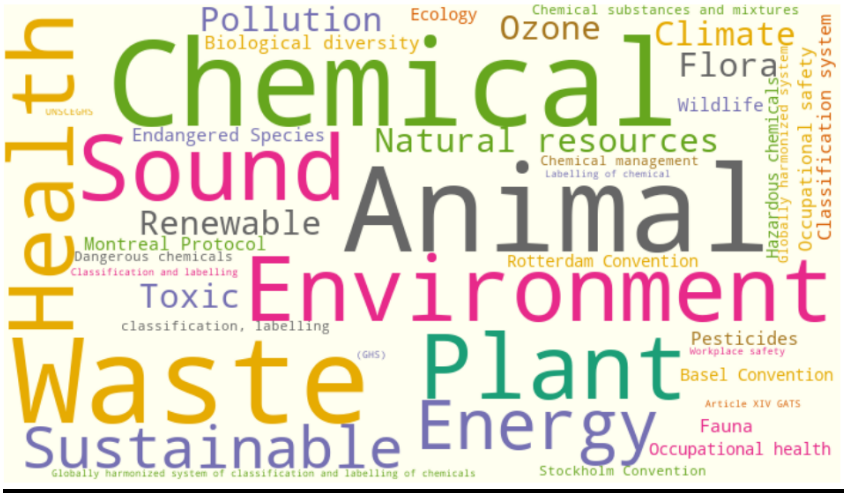
4 Results

In this Section, we present the results of our analysis of the presence of keywords in the international trade agreements collected, and about the status of GHS implementation.

4.1 Keywords in International Agreements

Figure 3 presents a word cloud, which is a visual representation of the frequency of our keywords in the international trade agreements in our sample.

Figure 3. Word cloud of keywords in the international agreements in our sample.



Let us focus on the use of the keyword “Chemical”. As seen in figure 3, the keyword “Chemical” is referred to in many of the international agreements we collected. Out of 327 international agreements analysed, it is mentioned 10 280 times in 159 agreements. This is to say, it appears on average approx. 65 times per agreement. For comparison, keywords such as animal, waste, environment, energy and health appear on more agreements (i.e., 262, 191, 221, 199 and 246 agreements, respectively), but mentioned fewer times per agreement (i.e., 62, 54, 32, 17 and 24 times, respectively).

To investigate the context of use of the keyword “Chemical” we focus on the agreements written in English. Figure 4 displays a word cloud of two-word phrases illustrating the context in which the keyword is mentioned. As seen in Figure 4, “Chemical” is often used in the context of agricultural chemicals (around 17% of the times the word is mentioned), followed by chemical materials (8.05%), and product chemical (2.67%).

Figure 4. Word cloud of the context of use of the keyword "Chemical".

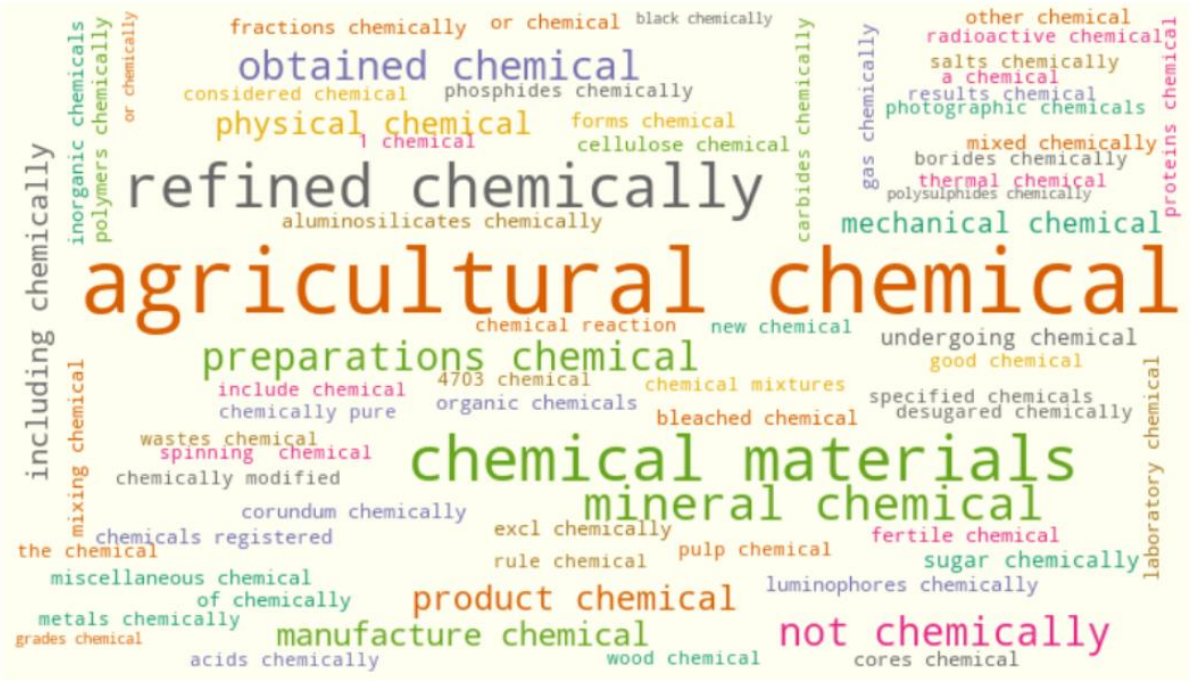


Figure 5 shows the most common parts of agreements referring to the top 20 two-word phrases of chemicals. In the Figure, the smaller the size and the lighter the color, the less common the two-word phrases of chemicals are in that part of the agreement. Moreover, the bubbles are in two color spectrums, blue and red, which indicates whether the words appear in the annexes or in the chapters of the agreements, respectively. Thus, as seen from Figure 5, references to chemicals appear often on annexes, concerning elimination of custom duties, tariff and country schedules, and product specific rules.

Finally, Figure 6 displays the frequency of the use of the top 20 two-word phrases of chemicals by different regional associations. The highest frequency of two-word phrases of chemicals within a specific association's agreements equals to 2270 times and belongs to the EU. The lowest frequency is equal to one time and belongs to SACU. Furthermore, some associations, such as ANZCERTA and ECOWAS, are not in the plot, because none of the top 20 two-word phrases of chemicals were found in their agreements.

Figure 5. Common parts of agreements referring to top 20 two-word phrases of chemicals.

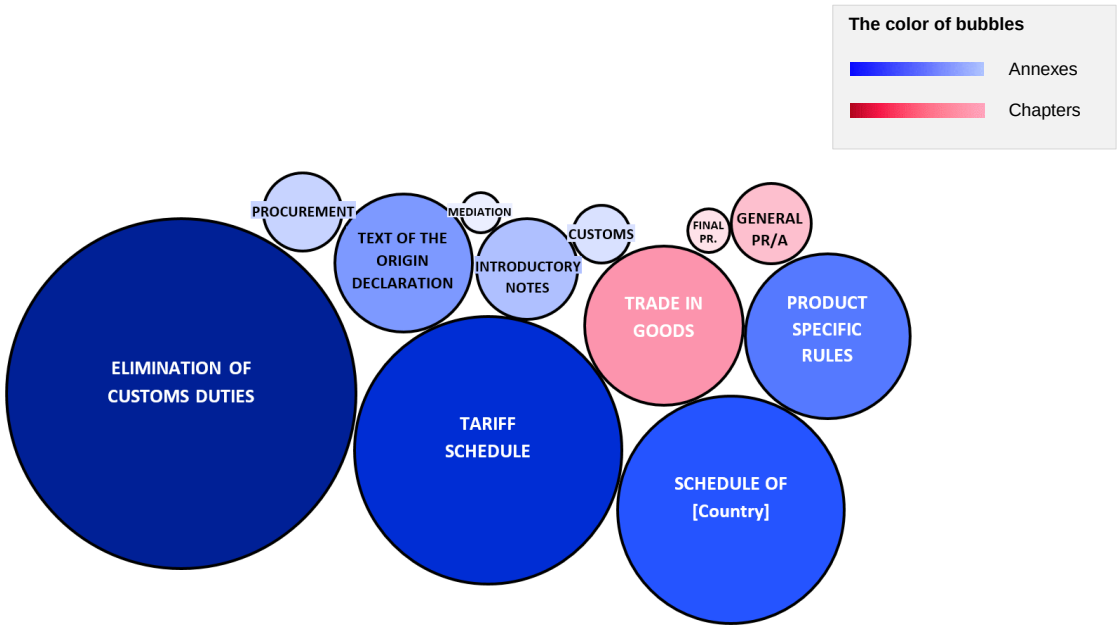
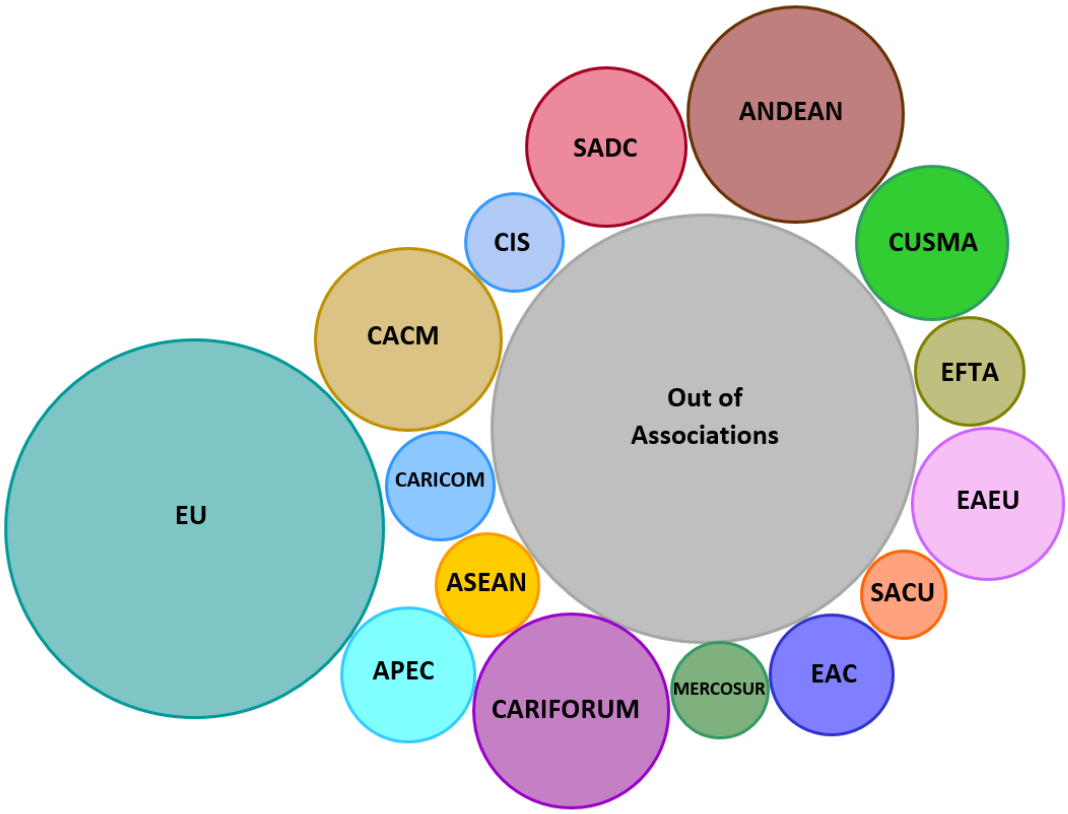


Figure 6. Use of the top 20 two-word phrases of chemicals by regional associations



From the plots above, we can conclude that the use of keyword “Chemical” occurs frequently in the context of chemicals used in agriculture and concerns the elimination of custom duties, tariff schedules and product specification. Moreover, such kind of provisions have been particularly common in bilateral trade agreements (and thus cannot be connected to specific

associations). Examples of texts referring to chemicals in the international agreements in our sample are presented below.

The United States-Colombia Trade Promotion Agreement 2006

Chapter 16: Intellectual Property Rights, Article 16.10: Measures Related to Certain Regulated Products

"If a Party requires or permits, as a condition of granting marketing approval for a new *agricultural chemical product*, the submission of information concerning safety or efficacy of the product, the Party shall not, without the consent of a person that previously submitted such safety or efficacy information to obtain marketing approval in the Party, authorize another to market a same or a similar product based on: (i) the safety or efficacy information submitted in support of the marketing approval; or (ii) evidence of the marketing approval…"

Statement on how the United States-Colombia Trade Promotion Agreement Makes Progress in Achieving U.S. Purposes, Policies, Objectives, and Priorities. C. Principal Trade Negotiations Objectives.

"Colombia will protect such information generated in connection with pharmaceutical and *agricultural chemical product* approvals for specific periods of time - normally five years for pharmaceuticals and ten years for *agricultural chemicals*. When relying on the United States' previous approval of a pharmaceutical product, and upon meeting certain other conditions for expeditious approval, the period of protection for test and other data in Colombia will be counted from the date of approval of that product in the United States."

Free Trade Agreement Korea-Peru 2011, Annex 2B: Elimination of Custom Duties

Except as otherwise provided in a Party's Schedule set out in this Annex, the following staging categories apply to the elimination of customs duties by each Party in accordance with ….

Schedule of Korea…. Material for manufacturing agricultural chemicals (registered material under the Agricultural Chemicals Management Act)

Free Trade Agreement between the European Union and the Republic of Singapore 2018

Section B: Standards Concerning Intellectual Property Rights, Sub-Section F: Protection of Test Data. Article 10.34 Protection of Test Data Submitted to Obtain an Administrative Marketing Approval to put an *Agricultural Chemical Product* on the Market

"Where a Party provides for measures or procedures to avoid duplicative testing on vertebrate animals with respect to *agricultural chemical products*, that Party may provide for the conditions and circumstances under which third parties may market the same or similar product on the basis of the marketing approval granted to the party which had provided the test data or studies."

Free Trade Agreement between the European Union and the Socialist Republic of Vietnam, 2020

Appendix 2-A…"Except as otherwise provided for in a Party's Schedule to this Annex, the following staging categories apply pursuant to Article 2.7 (Reduction or Elimination of

Customs Duties) to the reduction or elimination of customs duties on originating goods from the other Party included in Appendices 2-A-1 (Tariff Schedule of the Union) and 2-A-2 (Tariff Schedule of Viet Nam)…"

Appendices 2-A-1 (Tariff Schedule of the Union): "Arsenic, mercury, thallium or their mixtures, of a kind used for the extraction of arsenic or those metals or for the manufacture of their *chemical compounds".*

4.2 GHS in International Agreements

Our search of keywords reveals that to date, GHS has only being explicitly mentioned in four rather recent international agreements, namely, the EU-Japan agreement (in force since February 2019), the US-Can-Mex (CUSMA) Agreement (in force since July 2020), and the United Kingdom agreements with the EU and with Japan signed in 2020 in connection to the withdrawal of the United Kingdom from the European Union at the end of 31 January 2020.

The EU-Japan Agreement refers to GHS in the following terms:

Chapter 7 – Technical Barriers to Trade

ARTICLE 7.6 (1): For the purposes of applying this Chapter and the TBT Agreement, standards issued by international organisations such as the International Organisation for Standardisation (ISO), the International Electrotechnical Commission (IEC), the International Telecommunication Union (ITU), the Codex Alimentarius Commission, the International Civil Aviation Organisation (ICAO), the World Forum for Harmonisation of Vehicle Regulations (WP.29) within the framework of the United Nations Economic Commission for Europe (UNECE), the United Nations Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals (UNSCEGHS), and the International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) shall be considered as relevant international standards as referred to in this Chapter […].

The US-Can-Mex (CUSMA) Agreement refers to GHS in the following terms:

Chapter 12– Sectorial Annexes. Chemical Substances. Enhancing Regulatory Compatibility

Article 12.A.4 (6): The Parties shall strengthen their cooperation on chemical substances and chemical mixtures, including through the use of fora in existence. To that end, the Parties recognize potential areas of cooperation include: (a) their respective implementation of the United Nations Globally Harmonized System for Classification and Labeling of Chemicals (GHS)…

Based on the classification by Monteiro (2016), it can be said that the EU-Japan FTA is a FTA with only non-specific GHS-related provision and that the USMCA is a FTA with only specific cooperation provisions on GHS. Nevertheless, both USMCA and EU-Japan FTA are actually agreements with substantive specific environment-related provisions and provisions on environmental cooperation (See Appendix C).

Regarding the EU-Japan FTA agreement, EU members and Japan were among the first countries to implement GHS. Japan was the first country to adopt the GHS in 2006 following the revision of the Industrial safety and Health Law (ISHL). The EU issued the regulation on classification, labelling and packaging of substances and mixtures (CLP) - which is the equivalent to the GHS - in 2008. Thus, EU and Japan took a mandatory approach to implementation by aligning their state's chemical management policies and programs with

the core elements of the GHS (see Jonai et al. 2014). To date, GHS implementation in the EU and Japan covers all sectors (i.e., workplace, consumers and agriculture).

Even if GHS implementation in EU and Japan took place long before the 2019 agreement, the provision in the EU-Japan RTA is relevant because the WTO TBT Agreement does not provide a list of relevant international standards or international standardization bodies (though it provides a definition of what is a standard and what is an international body). The provision in the EU-Japan FTA implies that standards developed by UNSCEGHS are considered as relevant international standards. Therefore, any (compulsory) technical regulations based on and in compliance with UNSCEGHS standards are presumed not to create unnecessary obstacles to international trade. That means that in case of a dispute, if one of the parties considers that a technical regulation based on UNSCEGHS is in violation of the TBT chapter (e.g. the party claims it's a discriminatory regulation), it has to demonstrate that the technical regulation creates unnecessary obstacles to international trade despite being based on a relevant international standard. Based on existing WTO jurisprudence on the TBT Agreement, this means demonstrating that there is an alternative measure that achieve the same objective but is less trade restrictive than the technical regulation at issue.

Regarding the US-Can-Mex Agreement, the United States implemented GHS in the workplace in 2015 by revising the Hazard Communication Standard (HCS) issued by the Occupational Safety and Health Administration (OSHA) in 2012. Implementation of GHS in Canada took place also in 2015 with the issuing of the Hazardous Products Regulations (HPR), which modified the existing national regulation to incorporate GHS for workplace chemicals and came fully into force on 2018. Finally, Mexico published the harmonized system for the identification and communication of hazards and risks from hazardous chemicals in the workplace on 2015, which came fully into force on 2018. During the transitional period, companies could voluntarily prepare safety data sheets and labels according to GHS in Spanish.

Thus, all the countries in the agreement have implemented GHS rather recently. All of them only on the workplace. They have to date different versions of GHS in place. United States uses the GHS revision 3 version while Canada and México use GHS revision 5. Despite GHS implementation, there continue to be several differences between hazard communication in the US, Canada and México. Highlights of major differences between GHS adoption by Mexico and by the US and Canada include the adopted classification thresholds, and the fact that Mexico did not adopt any of the special hazards adopted by the US and Canada. Highlights of major differences between GHS adoption by the US and Canada include the fact that certain chemical substances classified in Canada are considered out-of-scope for American hazard communication standards. In August 2019, OSHA and Health Canada issued three new joint guidance documents to support implementation of GHS. A comparison of regulatory processes in Canada and the United States for hazardous products in the workplace; a comparison of the requirements for shipped labels under OSHA's HazCom 2012 standard and with Canada's Hazardous Product Regulations (HPR), and guidance on hazards not otherwise classified. Overall – given the implementation status and differences in hazard classifications – the provision in the US-Can-Mex Agreement acknowledges cooperation that is ongoing trying to bridge implementation differences.

The fact that GHS has only been referred to in few rather recent international trade agreements is a reflection of the fact that GHS implementation is rather recent even in countries with a long tradition of environmental protection.

Regarding the agreements signed by the United Kingdom in connection to its withdrawal from the EU, the United Kingdom agreement with the EU refers to GHS in the following terms:

Annex TBT-3: Chemicals // Article 6: Classification and labelling of chemicals

1. Each Party shall implement the UN GHS as comprehensively as it considers feasible within its respective system, including for chemicals that are not within the scope of this Annex, except where there are specific reasons to apply a different labelling system for particular chemical products in their finished state intended for the final user. Each Party shall periodically update its implementation based on the regularly issued revisions of the UN GHS.

2. Where the responsible authority of a Party intends to classify individual substances in accordance with its respective rules and procedures, it shall give the responsible authority of the other Party the possibility of expressing its views in accordance with those respective rules and procedures within the applicable timelines.

3. Each Party shall make information about its procedures related to the classification of substances publicly available in accordance with its respective rules and procedures. Each Party shall endeavour to respond to comments received from the other Party pursuant to paragraph 2.

4. Nothing in this Article shall oblige either Party to achieve any particular outcome regarding the implementation of the UN GHS in its territory or regarding the classification of a given substance, or to advance, suspend or delay its respective procedures and decision-making processes.

Thus, the agreement confirms that under UK's independent chemicals regulatory framework, the GB Classification, Labelling and Packaging of substances and mixtures Regulation (GB CLP) will be consistent with the UN GHS.

Finally, The United Kingdom agreement with Japan refers to GHS in the same terms as the agreement between EU and Japan, i.e.

Chapter 7 Technical Barriers to Trade. Article 7.6. International Standards

For the purposes of applying this Chapter and the TBT Agreement, standards issued by international organisations such as the International Organisation for Standardisation (ISO), the International Electrotechnical Commission (IEC), the International Telecommunication Union (ITU), the Codex Alimentarius Commission, the International Civil Aviation Organisation (ICAO), the World Forum for Harmonisation of Vehicle Regulations (WP.29) within the framework of the United Nations Economic Commission for Europe (UNECE), the United Nations Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals (UNSCEGHS), and the International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) shall be considered as relevant international standards as referred to in this Chapter […].

The UK's recent departure from EU might thus strike new trade deals around the world, including provisions to promote the GHS.

4.3 GHS in TBT and SPS Notifications

From September 2006 to September 2020, 12 individual countries plus the European Union submitted 34 notifications referring to GHS. The countries include Brazil, Canada, Chile, Colombia, Costa Rica, Israel, Jamaica, New Zealand, Switzerland, Thailand, Taiwan, United States, and the EU countries. The timing of such notifications is presented in Table 1.

Table 1. GHS Notifications to TBT and SPS per country/year

Year Notification	Country
2006	**USA**
2007	**EU**, **TAIWAN**
2009	**CANADA**, EU, USA
2010	**BRAZIL**, USA
2011	TAIWAN
2012	EU
2013	EU, **ISRAEL**
2014	CANADA, **JAMAICA**
2015	EU, **THAILAND**
2016	**COSTA RICA**, USA
2017	**CHILE, COLOMBIA**
2018	BRAZIL, EU, ISRAEL
2019	CHILE, EU, ISRAEL, TAIWAN
2020	**NEW ZEALAND, SWITZERLAND**

These notifications correspond mainly to TBT notifications (32 out of 34) concerning the implementation of criteria for evaluation and toxicological classification of chemicals, amending regulations of hazard communication standards in place, and updating hazardous chemical regulations to conform to GHS. They have a determined deadline for comments and the name and address of the authority designated to handle comments regarding the notification. In addition, a proposed date for adoption and a proposed date for entry into force were provided. We have organized all these 34 notifications and the information given in them into Table 2.

We can thus conclude that GHS has been refereed much more often in the notifications to TBT than in international agreements. Given that GHS implementation in most countries that have implemented so far has taken place gradually over the last decade, it is logical that countries would have informed other WTO members about GHS implementation in advance to the actual implementation, in conformity with the TBT agreement.

Table 2. Brief Description of the Content of GHS Notifications to TBT and SPS

Country	Date	Content in brief
BRAZIL GHS for industrial chemicals at workplace adopted since 2010	2010-11-26	G/TBT/N/BRA/403: It notifies the intent to develop, revise, alter, consolidate and standardize the procedures and technical requirements to implement GHS.
	2018-04-03	G/TBT/N/BRA/802: It notifies that companies are responsible for all labeling and package leaflet information, and must present it clearly and ensure that it is adequate and sufficient for health protection purposes.
	2018-04-03	G/TBT/N/BRA/803: It notifies the obligatory information related to the protection of human health that must be included in labels and leaflets of pesticides, components, related products, and wooden preservatives and the adoption of the labeling guidelines of GHS.
	2018-04-16	G/SPS/N/BRA/1388: This notification seems to be quite similar to G/TBT/N/BRA/802 notification, except that the range of products it covers is slightly different.
	2018-04-16	G/SPS/N/BRA/1389: This notification seems to be quite similar to G/TBT/N/BRA/803 notification, except that the range of products it covers is slightly different.
CANADA GHS for industrial chemicals at workplace adopted since 2015	2009-12-23	G/TBT/N/CAN/290: Among others, the notification stated that a proposal on the GHS is being considered to be added to the text of the Canada Consumer Product Safety Act
	2014-09-25	G/TBT/N/CAN/425: This notification is about regulatory amendments of the Controlled Products Regulations, which replaced Canada's previous hazard communication standard with new regulations based on the GHS.
CHILE About to implement GHS	2017-11-13	G/TBT/N/CHL/422: The notified draft regulation establishes criteria and procedures for classification, labelling, and providing safety data sheet for chemical substances. It is stated that the regulations implement GHS.
	2019-01-04	G/TBT/N/CHL/422/Add.1: The addendum publishes all the received comments and responses on the draft regulations on the classification, labelling, and notification of chemical substances and mixtures.
COLOMBIA Implemented GHS in 2018	2017-11-29	G/TBT/N/COL/229: It notifies the Draft Ministry of Labor Decree "Adopting the GHS and issuing other provisions on chemical safety".
COSTA RICA Transition to implementation	2016-11-30	G/TBT/N/CRI/163: It notifies the labelling requirements for hazardous chemicals, in accordance with GHS.

EUROPEAN UNION Adopted CLP regulation in 2008	2007-09-14	G/TBT/N/EEC/163: It notifies that GHS will be incorporated into EU legislation, for the first time.
	2009-08-19	G/TBT/N/EEC/295: It notifies that Annex II of REACH will be amended in order to align it with the provisions of Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures as well as GHS.
	2010-08-10	G/TBT/N/EEC/348: It notifies that the Annexes of the CLP Regulation will be adapted to the 3rd revision of the GHS and clarifies certain technical provisions and criteria in the Annexes.
	2012-07-23	G/TBT/N/EU/52: It notifies that the Annexes of the CLP Regulation will be adapted to the 4th revision of the GHS and clarifies certain technical provisions and criteria in the Annexes.
	2013-08-09	G/TBT/N/EU/142: It notifies the intent to align Directive 97/23/EC on pressure equipment to the "goods package" to Decision No 768/2008/EC establishing a common framework for the marketing of products. It also notifies the intends to align Directive 97/23/EC to Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures.
	2015-06-19	G/TBT/N/EU/289: It notifies that the Annexes of the CLP Regulation will be adapted to the 5th revision of the GHS and clarifies certain technical provisions and criteria in the Annexes.
	2018-07-20	G/TBT/N/EU/586: It notifies the intent to adapt the technical provisions and criteria in the Annexes to Regulation (EC) No 1272/2008 to the 6th and 7th revised edition of the GHS.
	2019-09-09	G/TBT/N/EU/680: It notifies the update of Annex II to Regulation (EC) No 1907/2006 (REACH) to align with the GHS Rev. 6 and 7, and also CLP.
ISRAEL Implemented GHS in 2019	2013-12-03	G/TBT/N/ISR/726: It notifies revisions of the mandatory standard SI 2302 Part 1 on transportation of dangerous substances and mixtures, to get closer to GHS.
	2018-08-28	G/TBT/N/ISR/726/Rev.1: It notifies that the mandatory standard SI 2302 Part 1, has been amended and replaced.
	2018-08-28	G/TBT/N/ISR/1025: It notifies revisions of the mandatory standard SI 2302 Part 2 on transportation of dangerous substances and mixtures, to include GHS symbols.
JAMAICA No information	2014-07-10	G/TBT/N/JAM/42: It stipulates that the general labelling requirements for retail packages of pesticides must conform GHS.

NEW ZEALAND All hazardous substances covered by GHS-based legislative framework since 2006	2019-11-07	G/TBT/N/NZL/92: It seeks input on a range of proposals to moving to GHS revision 7.
	2020-06-08	G/TBT/N/NZL/100: It notifies updates in order to replace the current standards for hazardous substances with GHS 7.
SWITZERLAND Implemented GHS in 2012	2020-09-30	G/TBT/N/CHE/250: It notifies the draft revision updating the list of harmonized classifications law to be adapted to technical progress in the EU (15th ATP of the EU CLP Regulation).
TAIWAN GHS for selected chemicals since 2008. Full GHS implementation in 2017 for chemicals in workplace	2007-05-24	G/TBT/N/TPKM/49: It establishes labeling requirements. The proposed criteria were drafted in line with the GHS.
	2011-07-04	G/TBT/N/TPKM/102: It notifies amends to the Labor Safety and Health Act to require obligations of hazardous chemicals operators to label, register, evaluate and obtain permit of hazardous chemical substances.
	2019-02-26	It is stated that GHS has been fully implemented in Taiwan since January 1, 2017. The Taiwan National Standards CNS 15030 Z1051 Chemical Classification and Labeling were established based on GHS. This notification is about amending of Agro-pesticides Labelling Management Regulation by the Council of Agriculture, in order to strengthen the pesticide labeling management and comply with the international norms.
THAILAND GHS SDSs and labels required for hazardous substances since 2013 and since 2017 for mixtures	2015-01-07	G/TBT/N/THA/441: It mandates manufacturers, exporters, and importers of consumer products (used in household or public health) to define and classify chemicals hazards conform to GHS.
	2015-05-06	G/TBT/N/THA/457: It states that GHS is implemented as a regulation into the hazardous substances used in household or public health (consumer products). Some symbols and classification criteria that were used did not comply with the GHS and this notification attends to correct it.
UNITED STATES Implemented GHS in the workplace in 2015	2006-09-15	G/TBT/N/USA/216: The adoption of the GHS by OSHA would require modifications to the Agency's Hazard Communication Standard (HCS). In this notice, OSHA is providing further information about the GHS, the benefits of adopting it, and its potential impact on the HCS.
	2009-10-07	G/TBT/N/USA/216/Add.1: It notifies proposed modification to the United States' previous Hazard Communication Standard (HCS) to conform to the GHS.
	2016-07-14	G/TBT/N/USA/1162: It notifies that the Environmental Protection Agency of US is amending its hazardous chemical reporting regulations to conform to GHS.

4.4 GHS and the OECD Decision-Recommendation on the Co-operative Investigation and Risk Reduction of Chemicals (25 May 2018)

The OECD Decision-Recommendation on the Co-Operative Investigation and Risk Reduction of Chemicals is expected to drive GHS implementation of middle-income countries that want to become members of the OECD. In May 2018, the OECD made it mandatory for member countries, and those in the process of becoming so, to implement GHS. In particular, it decided that members shall implement the GHS in order to further hazard communication in the supply chain. Such implementation can be done by members applying those elements of the GHS that are appropriate to them and may vary by product category and stage in the lifecycle. It also recommended that members communicate and share classifications derived pursuant to the GHS with other members.

OECD Decisions are a legally binding instrument on all members except those that abstain at the time of adoption. Thus, members are obliged to implement decisions and must take the measures necessary for such implementation.

Even if the immediate implications were expected to be small because most OECD countries have already implemented the GHS, the new accession countries will be compelled to implement the GHS. For instance, Colombia aligned its chemical management to comply with the requirements of OECD membership. The OECD opened talks with Colombia in 2013, but it was not until May 2018 that Colombia was officially invited to become a member. On August 2018, Colombia's Labour Ministry published a decree implementing the sixth edition of GHS. Decree 1496 covers the manufacture, import, storage, transportation, distribution, marketing and use of chemical substances and mixtures detailing the responsibilities of each actor in the chemicals supply chain.

The OECD Decision-Recommendation of the Council on the Co-operative Investigation and Risk Reduction of Chemicals became also a driver of GHS implementation for Israel and Chile. Israel is an OECD member country since 2010 and, as such, in 2018 it was required to implement GHS based on the OECD Decision-Recommendation of the Council on the Co-operative Investigation and Risk Reduction of Chemicals. Israel published its implementation of the Globally Harmonized System (GHS), on May 12, 2019. The new requirement will take with a 3-year transition period until August 9, 2022. Chile also joined the OECD in 2010 (the first South American country to do so). Chile was asked by the OECD's chemistry committee to publish the regulation by the end of 2019.

Peru is a country that has expressed interest in OECD membership and has not yet implemented GHS.

4.5 GHS implementation, international trade and regional cooperation

Two key questions of relevance to this report are whether international free trade agreements have played an explicit role promoting GHS implementation and whether regional cooperation has supported implementation. As discussed previously, to date GHS has only being explicitly mentioned in two rather recent free trade agreements. All the countries involved in such agreements had already implemented GHS when the trade agreements were signed. Furthermore, plans for GHS implementation have been notified by several countries conforming to the TBT agreement.

That trade agreements so far have not referred to GHS does not mean that they do not have the potential to encourage GHS implementation in the future. Particularly, because GHS has been referred to in agreements involving countries with large flows of trade. Thus, it can be expected that environmental provisions concerning GHS become more common in the future, as EU, UK, Japan, the United States, Canada and Mexico sign treaties with other countries and/or regional associations. The UK's recent departure from EU hints in such direction as the new agreements signed by UK include provisions on GHS.

Regarding the role of regional cooperation encouraging and supporting implementation, as highlighted by Persson et al. (2017), trade openness and regional cooperation are positively correlated with GHS implementation. Nevertheless, based on logistic regression analysis, they show that government effectiveness is the strongest predictor of GHS implementation status, followed by political globalization and commitment to occupational safety. This is to say, regulatory constraints seem to be the major factor explaining the gap in GHS implementation. Table 3 presents the rate of GHS implementation for the regional associations included in our sample. In the table, we consider that implementation has occurred for those countries with implementation in force, in transition and voluntary GHS implementation. We observe a great deal of variation in the rate of GHS implementation across associations. Full implementation in associations by developed nations – such as ANZCERTA and EU - and no implementation in associations in regions with capacity constraints, particularly in Africa.

Thus, even if there is a clear potential to share knowledge about GHS implementation through regional associations, the institutional development and regulatory constraints of their members seem to be the key explanatory factor behind the variation on the rate of implementation across associations. As mentioned in Section 3.4, major activities required for implementation include the identification of gaps between the GHS and existing national laws, the actual classification of chemicals and communication to target audiences. The knowledge accumulated through the implementation of other countries, and particularly from other countries in the same region, should facilitate the development of such tasks for the countries yet to implement. Furthermore, The UN GHS Sub-Committee has developed technical assistance for developing countries to write new regulations using the GHS elements.[1]

Thus, provided the national political support exists, the stock of experiences so far should facilitate implementation from laggard countries. The question is then whether the political support exists. While the development of implementation plans by regional associations and individual countries might be encouraged, it is still up to the countries to decide whether and when to adopt GHS as GHS adoption is voluntary. Trade agreements and aspirations to join economic associations have shown to be effective providing the political support required for GHS implementation and might play an important role reducing the implementation gap. For instance, Table 3 shows the number of international trade agreements signed by the countries belonging to the associations, in comparison to the international agreements signed by the association. For most associations but the European Union, trade agreements seem to take place on a bilateral basis. Such pattern suggests that through its future trade agreements with individual countries, EU has the potential to spur GHS implementation. Furthermore, since individual countries largely negotiate their trade agreements on their own, large and prominent member countries such as United States, Japan, UK, Canada and Mexico can become significant stakeholders to promote provisions concerning GHS as they sign new trade agreements.

[1] https://cwm.unitar.org/national-profiles/publications/cw/ghs/GHS_GD_September2010.pdf

Table 3. Rate of GHS Implementation by Regional Associations

Association	# Full Members	Rate of GHS Implementation	#Agreements Association	Average #Agreements per country in the Assoc.
Andean Community	4	50%	3	14.75
ANZCERTA	2	100%	1	16.50
APEC	21	86%	2	18.71
ASEAN	10	70%	6	19.20
CACM	5	20%	1	10.40
CARICOM	15	0%	1	3.79
CARIFORUM	16	0%	2	3.94
CIS	9	100%	1	3.89
CUSMA	3	100%	1	19.33
D-8	8	37.5%	1	11.13
EAC	6	0%	1	0.63
EAEU	5	100%	3	4.80
ECO	10	70%	2	6.10
ECOWAS	15	0%	1	1.20
EFTA	4	100%	26	23.75
GCC	6	100%	2	2.83
EU	27	100%	35	31.37
MERCOSUR	5	60%	11	13.20
SAARC	8	0%	1	7.38
SACU	5	20%	3	5.40
SADC	16	12.5%	2	3.06

An analysis of the information provided by Cefic (2020) indicates that 56% of the countries that have implemented GHS so far have done it with the aim of becoming a member of a particular association. As shown in Table 4, most of such countries belong to the European Union or had the aim of increasing collaboration with the EU. For instance, Albania aspires to increase collaboration with the European Union, and GHS implementation is part of a legislative alignment that will support the accession process. Moreover, the Serbian implementation follows the EU CLP due to EU accession negotiations currently ongoing.

Table 4. Countries that report to have implemented GHS to become members of an association.

Association	Countries
CIS	Armenia Azerbaijan Belarus Kazakhstan Kyrgyz Republic Moldova Russia Tajikistan Turkmenistan Uzbekistan
EFTA	Iceland Liechtenstein Norway
EU	Austria Belgium Bulgaria Croatia Cyprus Czech Republic Denmark Estonia Finland France Germany Greece Hungary Ireland Italy Latvia Lithuania Luxembourg Malta Netherlands Poland Portugal Romania Slovak Republic Slovenia Spain Sweden Albania* Serbia* United Kingdom**
Mercosur	Uruguay

Source: Cefic (2020)
(*) Accession negotiations to the European Union
(**) Member of EU until December 2020.

From the information provided by Cefic (2020), it seems that Uruguay is the only country outside the European/Eurasian region that has implemented GHS due to participation in a regional association. Uruguay is a member of the MERCOSUR Ad Hoc Group on Chemicals, which identified GHS implementation as one of the six issues of highest priority for the region. Uruguay launched of the project "National awareness raising and capacity assessment for GHS implementation" with the support of UNITAR/ILO and the government of Switzerland.

Finally, as described in Section 4.4, In May 2018, the OECD made it mandatory for member countries, and those in the process of becoming so, to implement GHS. Such requirement led to GHS implementation by Colombia, Chile and Israel and it is expected to drive GHS implementation by new accession countries.

5 Conclusions

Many accidents and diseases caused by chemicals occur every day. The ILO estimates that hazardous substances alone cause 651,279 deaths a year. The GHS has great potential as a preventative strategy in advanced chemical management as well as a tool for hazard information dissemination. Global GHS implementation has been an objective of the international community for more than two decades. Nonetheless, implementation of GHS is still partial and significant regional differences in GHS implementation coverage are observed. Given the voluntary nature of GHS adoption and considering the urgency of improving chemical management in countries with fast growing chemicals industries that lack chemical management systems, it is important to use a broad range of instruments to close the GHS implementation gap.

Regional and bilateral free trade agreements allow countries to reduce trade barriers and develop new rules to promote green goods and services. Classification and harmonization of chemicals in accordance to the GHS is one perfect example of a win-win of the relationship between trade and environment. They can lead to increased trade because they reduce information asymmetries and transactions costs while enhancing the protection of human health and the environment. Many governments are increasingly recognizing the need to ensure that trade agreements reflect environmental concerns to help achieve overarching environmental goals and to increase their public acceptability. Even though environmental provisions concerning issues such as renewable energy, climate change and biodiversity protection are increasingly common, to date, GHS provisions have been raised only in few international agreements.

Why are GHS provisions not common in international trade agreements to date? The fact that GHS has only been referred to in few rather recent international trade agreements seems to reflect the fact that GHS implementation is rather recent even in countries with a long tradition of environmental protection. However, since GHS has been referred to in agreements involving countries with large flows of trade, environmental provisions concerning GHS might become more common in the future when those countries sign treaties with other countries and/or regional associations. For instance, the EU's most recent trade agreements mention the GHS, with Japan and most recently with the UK. This hopefully becomes the standard for future EU trade negotiations, whether with states that have implemented the GHS or not. Furthermore, since individual countries largely negotiate their trade agreements on their own, large and prominent member countries such as United States, Japan, UK, Canada and Mexico can become significant stakeholders to promote provisions concerning GHS as they sign new trade agreements.

The GHS has been refereed much more often in the notifications to TBT than in international agreements. Given that GHS implementation in most countries that have implemented so far has taken place gradually over the last decade, it is logical that countries would have informed other WTO members about GHS implementation in advance to the actual implementation, in conformity with the TBT agreement. Stakeholders should continue to encourage notifications to the WTO TBT committee in relation to the GHS. This would help share updates (the primary aim) but also further normalize the practice and consideration of the links between the GHS and trade

Regarding the role of regional cooperation encouraging and supporting GHS implementation, even if there is a clear potential to share knowledge about GHS implementation through regional associations, countries' institutional development and regulatory constraints seem to

be the key explanatory factor behind the lack of implementation. Political will and resources to overcome regulatory constraints are thus crucial to reduce the GHS implementation gap. Trade related motivations have shown to be effective in providing the political support required for GHS implementation, particularly in the EURASIAN region. The OECD decision to make GHS implementation mandatory for member countries and those in the process of becoming members is also expected to increase the political will among middle-income countries with the aspiration to become OECD members.

From the analysis of global implementations so far, it is clear that GHS adoption and implementation are a multi-year journey, therefore an early start and long-term commitment are both critical. Engagement of multiple stakeholders and commitment of all concerned agencies are critical to raise awareness and build a compelling case for the adoption of GHS into national regulations.

Finally, the lack of resources and capacity has been continuously raised as a key obstacle to GHS implementation in non-OECD countries. Nonetheless, currently, numerous governments, intergovernmental organizations, industry associations and companies, and civil society organizations undertake and fund capacity-building activities supporting chemical management in developing countries and countries with economies in transition. According to studies developed by Cefic, challenges faced in such capacity building activities is that they are ad-hoc, fragmented and lack continuity and ownership by both the receiving as well as the providing party. In addition, the existing local industry expertise available to make the activities efficient are not used to their full potential. Improving capacity building coordination would promote transparency and accountability. Long-term commitments by receiving parties, the use of the expertise available within the countries, and follow-up mechanisms can enhance the effectiveness of capacity building activities and to ensure that such capacity can be sustained after the funding is terminated.

6 Discussion

Based on the evidence available on ISO certification, it is clear that there is an interrelationship between trade and the adoption of international standards: On the one hand, trade is an important driver behind the adoption of international standards. On the other hand, trade flows increase once the standard has been adopted. Furthermore, the pattern of adoption of ISO standards resembles that of GHS in the sense that (firms in) developed countries were among the first to adopt, which in turn influenced (firms in) other countries.

The type of barriers that have hindered the adoption of ISO standards by firms in developing countries are largely the same that hinder GHS implementation, namely, the lack of financial and human resources, insufficient technical knowledge of quality management, and the lack of knowledge of formalized systems. Nevertheless, unlike GHS implementation, third-party certification can bridge national regulatory constraints since being certified to a standard that is accepted in the importing country can help overcome the constraints imposed by the lack of local regulations and capacity.

In line with the evidence available on ISO certification, the literature describing the effects of TBT and SPS notifications on trade point to a positive effect of standardization though implementation costs would be faced by developing countries in the short run. Similar findings appear in studies investigating the effects of environmental provisions in trade flows of developing countries that show that environmental provisions can help reduce dirty exports and increase green exports and that this effect is particularly pronounced in developing countries with stringent environmental regulations.

Thus, a bulk of evidence supports the claim that greening now is better than growing first and cleaning up later. In the case of GHS, countries might gain much from speeding up implementation, in addition to increased trade flows. For instance, fewer chemical accidents and improved protection of workers and the public from chemical hazards, increased efficiency and reduced costs from compliance with hazard communication regulations, and improved corporate image and credibility. Environmental provisions concerning GHS cannot substitute for environmental reforms at the country level required to improve the management of chemicals, but can provide incentives to speed up the transition to a sustainable chemical management.

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Appendix A: Contacts

Organizations	Contacts	Main Objetive
Swedish Chemicals Agency (KEMI)	Sofie Johansson	Understand terminology of international trade agreements
National Board of Trade Sweden	Anna Sabelstrom and others	Understand how environmental issues are brought up on the negotiations of free trade treaties.
UNITAR	Oliver Wootton and Alejandra Acosta	Understand drivers and challenges of implementation and practical experiences.
Cefic	Servet Goren and Maria Ruiz-Cuevas	Understand drivers and challenges of implementation and practical experiences.
OECD	Bob Diderich and Shunta Yamaguchi	Discussion about existing evidence and data on the implementation of environmental provisions in regional trade agreements
WTO Economic Research and Statistics Division	José Antonio Monteiro	Discussion about existing evidence and data on the implementation of environmental provisions in regional trade agreements
WTO Trade and Enviroment	Daniel Ramos and Serra Ayral	Discussion about existing evidence and data on the implementation of environmental provisions in regional trade agreements
GHS Implementation Secretariat	Rosa Garcia Couto	Understand quality of data on status of implementation
Stockholm Environmental Institute	Linn Persson	Understand quality of data on status of implementation

Appendix B: GHS Implementation in Transport

For the transport of dangerous goods, GHS is implemented through the UN Recommendations on the Transport of Dangerous Goods Model Regulations and the following transport legal international instruments:

(a) International Maritime Dangerous Goods Code (IMDG Code);

(b) ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO TI);

(c) European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR);

(d) Regulations concerning the International Transport of Dangerous Goods by Rail (RID);

(e) European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN);

The sixth revised edition of GHS made mandatory the provisions of the 19th revised edition of the UN Model Regulations.

In order to know which countries have implemented GHS in the transport sector, we searched for information about which countries have implemented the different transport legal instruments.

Figure 7 shows an overview of the status of GHS implementation of GHS around the world. 16 countries have implemented GHS in all modes of transport, 22 countries have implemented GHS in four modes of transport, 13 countries have implemented GHS in three modes of transport, 118 countries have implemented GHS in two modes of transport and 25 countries have implemented GHS in one mode of transport. Furthermore, GHS has been mostly implemented in maritime and air transport.

Maritime Transport:

International Maritime Dangerous Goods Code (IMDG Code):

The IMDG Code, 2018 Edition came into force on 1 January 2020. The IMDG Code is mandatory for 162 countries parties to the International Convention for the Safety of Life at Sea (SOLAS).

Air Transport:

ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO TI):

The ICAO TI are mandatory for the 193 countries parties to the Convention on International Civil Aviation.

Land Transport:

The provisions on the carriage of dangerous goods by rail are harmonized with the provisions for road transport (ADR) and inland waterways transport (ADN).

European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR):

It is a UN treaty that governs transnational transport of hazardous materials. From 1 January 2021, the treaty will be renamed Agreement concerning the International Carriage of Dangerous Goods by Road as the word "European" in the original name may give the impression that the treaty is only open for accession to European states. As of 2020, 52 states are party to ADR. The ADR is mandatory for domestic traffic in EU and EEA countries through European Directive 2008/68/EC* and in the Russian Federation (Ordinance No.272 of 15 April 2011).

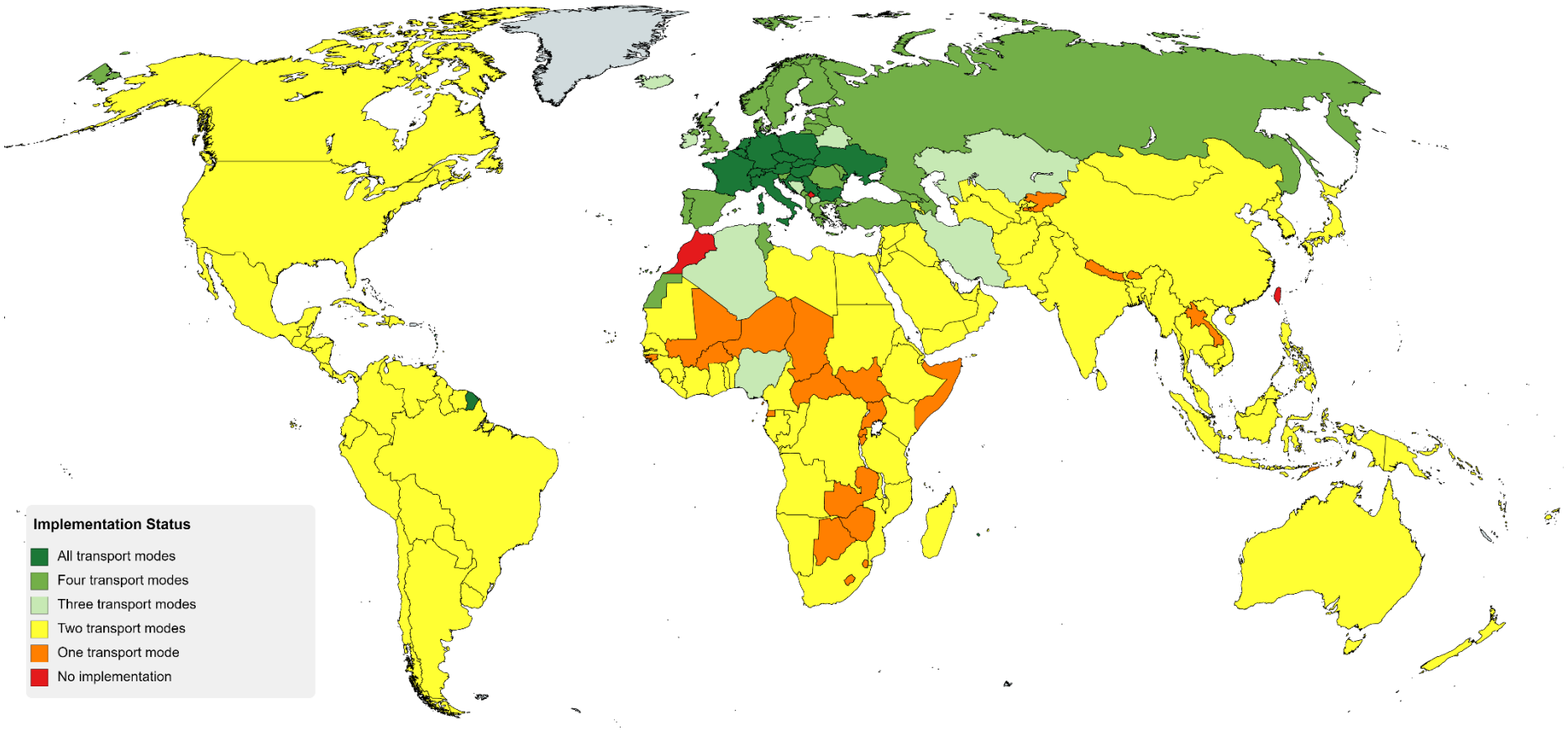
Regulations concerning the International Transport of Dangerous Goods by Rail (RID):

The RID is mandatory for domestic traffic in EU and EEA countries through European Directive 2008/68/EC.

European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN):

It entered into force on 29 February 2008. The ADN is of mandatory application for domestic traffic in EU and for EEA countries through European Directive 2008/68/EC.

Figure 7. Overview of GHS Implementation in the Transport Sector in the World



Appendix C: Keywords in USMCA and EU-JPN

Keywords	Counts in USMCA	Counts in EU-JPN
Globally harmonized system of classification and labelling of chemicals	0	1
Globally harmonized system	1	1
Classification and labelling	0	1
classification, labelling	0	0
UNSCEGHS	0	1
(GHS)	1	0
GHS label	0	0
Classification system	8	0
Labelling system	0	0
Hazardous chemicals	0	0
Dangerous chemicals	0	0
Transport of chemicals	0	0
Labelling of chemical	0	1
Classification of chemical	0	0
Chemical substances and mixtures	0	0
International chemical regulation	0	0
(CLP)	0	0
CLP regulation	0	0
Sound	107	9
Workplace safety	0	0
Occupational safety	4	0
Occupational health	0	1
Health	155	31
Minamata Convention	0	0
ILO Convention 170	0	0
Toxic	15	1
Pesticides	37	0
Circular economy	0	0
Chemical management	2	0
Health and environmental chemical safety	0	0
Chemical Safety	0	0
Animal	513	53
Article XIV GATS	0	0
Article XX GATT	0	0
Article 27 of the Agreement on trade-related aspects of intellectual property rights (TRIPS)	0	0
Basel Convention	0	0
Biological diversity	8	4
Chemical	272	55

Climate	5	9
Ecology	1	0
Endangered Species	3	4
Energy	73	7
Environment	205	72
Fauna	18	3
Flora	25	3
Montreal Protocol	4	0
Natural resources	20	3
Ozone	15	0
Plant	201	32
Pollution	23	0
Renewable	7	1
Rotterdam Convention	0	0
Stockholm Convention	0	0
Sustainable	37	41
Waste	335	10
Wildlife	4	1

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