Strategic Trade Review

Winter/Spring 2024

Strategic Trade Controls
A Systems Model

Strategic Trade Controls as a Foreign Policy Tool
A Shift Beyond Nonproliferation

The Sino-U.S. Technology War
Leveraging Technology Advantages through Economic Statecraft

Mitigating Climate Change
The Critical Role of Customs and Strategic Trade Controls

Stengthening Strategic Trade Controls
Stakeholder Ecosystem Assessment, Engagement, and Capacity Capture

Nonproliferation Controls to Support Research and Security
Risks and Challenges in Research Institutions and Universities

Strategic Trade Control of Transshipments
KYC-Based Best Practices for Counterproliferation

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Letter from the Editor

This 11th issue of the *Strategic Trade Review* illuminates the state of strategic trade controls in 2024: a field more in flux conceptually than ever before and yet still rooted, from a practical perspective, on the need for effective technical implementation.

Amid the prevailing dialogue dominated by the emerging concept of "economic security" — a term now ubiquitous across discussions led by a growing cadre of self-styled experts discussing export controls in strictly that context — the contributors of the issue's initial articles undertake a thoughtful and thorough examination. They delve into these contemporary trends through a lens that combines both a detailed historical perspective and a strategic trade framework, offering foundational analyses on these topics and their implications. On the conceptual level, the two articles explore the ever-expanding application of export controls to critical and emerging technologies and to achieve foreign and economic security objectives. In this context, they seek to understand the fundamental question of how implementation and effectiveness can be maintained within a weakened multilateral order and how to preserve focus on legacy nonproliferation and overall security objectives.

Other articles in this issue remind readers and the wider strategic trade - and economic security - stakeholder community that policies exist beyond simply the conceptual level. Instead, the real world of everyday effective implementation of strategic trade controls is complex, layered, technical, inter-disciplinary, involves a multitude of parties requiring specific expertise, and necessitates constant capacity-building and compliance strengthening efforts. The articles explore these elements – from a comprehensive systems model that all countries can understand and adopt for strategic trade control implementation to best practices for managing transshipment risks, strengthening research security, and implementing capacity-building programs.

Finally, an article in this issue on the potential application of export controls to address climate change threats challenges readers to consider the effectiveness of trade and enforcement tools for addressing new, yet unexplored areas.

As founder and editor-in-chief of the *Strategic Trade Review*, I am proud of the expansive and critical literature featured since the first issue was published less than a decade ago. From a relatively arcane field of study – if one could have even called it a "field" at the time – *STR* has contributed to building a community of research, practice, and lasting knowledge upon which effective policies and a more secure and peaceful world can be built. I am grateful for the incredible authors who entrust this journal with bridging their research and expertise with a

wide and global readership as well as to *STR*'s readers whose support and contribution to this endeavor is all-important.

I end this letter with a call to action. To date, *STR* has been a 100% voluntary endeavor, but voluntary work is not sustainable. If you value this publication, please reach out to me (viski@strategictraderesearch.org) with ideas for how to ensure its sustainability.

ANDREA VISKI

A Strategic Trade Control Systems Model

PETE HEINE, TYE BLACKBURN, HEIDI HAMLING[1]

Abstract

This article presents a Strategic Trade Control (STC) Systems Model developed by the United States Department of Energy's Office of Nonproliferation and Arms Control. The STC Systems Model describes the general functions that all STC systems must accomplish and the specific system components, unique to each national strategic trade control system, needed to accomplish them. By separating the functions STC systems need to accomplish from the specific choices countries make about how to accomplish those functions, this STC Systems Model provides a universal template any country can use to inform, assess, and improve their STC system.

Keywords

Strategic trade controls, export controls, systems modeling, capacity-building, implementation, licensing, enforcement, outreach

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Introduction

The United States Department of Energy Office of Nonproliferation and Arms Control, through its International Nonproliferation Export Control Program (INECP), has worked for more than thirty years with partners in dozens of countries worldwide to help them develop and strengthen their strategic trade control (STC) systems. This broad experience has revealed that while no two systems organize or implement STCs the same way, and there is no ideal "right way" to tackle STCs, all these STC systems share common elements. While countries find their own ways to implement STC, they all fundamentally implement a common set of functions, and all system functions depend on a common set of system components to enable them to work.

INECP created a STC Systems Model to describe these common elements. The genesis of the approach was based on a methodology developed by the Homeland Security Exercise and Evaluation Program (HSEEP) to guide exercise design, development, conduct, and evaluation. Development of the model also leveraged insights gained from INECP's STC training program, which uses a Systematic Approach to Training (SAT) for identifying needed knowledge, skills, and attitudes to perform many of the tasks associated with a successful STC system.

Despite the wide range of STC system types around the world, all countries can use this model to help guide efforts to strengthen their own STC systems. This article first describes the functions common to all STC systems (Section 1.0) and then discusses the system components that enable them (Section 2.0). Finally, in Section 3.0, the article discusses application of the model.

1.0. STC Functions: What STC Systems Do

At the most basic level, a country's STC system must regulate trade, ensuring that trade adheres to its laws and regulations, helping the country fulfill its international commitments and achieve its policy goals. While all STC systems are unique, they must nevertheless perform a common set of functions to accomplish these goals. First, they establish the rules governing strategic trade. Second, they promulgate those rules to promote compliance. Third, they regulate licit trade in accordance with those rules. Finally, they enforce those rules to prevent illicit trade.

Table 1. STC functions

STC Functions			
Establish Requirements	Promote Compliance	Authorize Trade	Prevent Illicit Trade

1.1 Establish Requirements

STC Systems are built upon a legislative and regulatory foundation defining rules, creating authorities, and allocating responsibilities. Four critical steps to establishing the requirements for a STC system are securing political will and commitment, creating the legislative and regulatory foundation, designating organizations and their authorities, and creating coordination mechanisms among them.

1.1.1 Securing Political Will and Commitment

Political will and commitment refer to a state's international commitment to nonproliferation of nuclear weapons, other Weapons of Mass Destruction (WMD), missiles, and conventional weapons, as well as preventing the spread of sensitive or controlled materials and equipment. It takes the form of memberships and adherence to a range of nonproliferation conventions, treaties, regimes, and groups.[2]

Political will and commitment for STC stem from three principal sources: implementing relevant United Nations Security Council resolutions (UNSCRs), signing and ratifying legally binding nonproliferation-related treaties, and declaring adherence to the norms established by the nonproliferation regime. Treaties include the Treaty on the Nonproliferation of Nuclear Weapons (NPT), the Chemical Weapons Convention (CWC), the Biological Weapons Convention (BWC), and the Arms Trade Treaty (ATT).[3] In the STC context, the norms of the nonproliferation regime refer to the guidelines developed and maintained by the Nuclear Suppliers Group (NSG), Missile Technology Control Regime (MTCR), Wassenaar Arrangement (WA), Australia Group (AG), Proliferation Security Initiative (PSI), and World Customs Organization (WCO).[4]

1.1.2 Creating the Legislative and Regulatory Foundation

When creating the legislative and regulatory foundation for STC, lawmakers and regulators are guided by the requirements of UNSCR 1540 and other UNSCRs imposing trade sanctions, treaties signed by their country, and the guidelines of the nonproliferation regime (as discussed in Section 2.1.1). This entails ensuring laws and implementing regulations are in place to require authorization to export certain controlled items (including materials, equipment, software, and

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2 David Albright, Sarah Burkhard, Spencer Faragasso, and Linda Keenan, "Peddling Peril Index," Institute for Science and International Security (ISIS), April 2022, <https://isis-online.org/ppi>.

3 Treaty on the Non-Proliferation of Nuclear Weapons, March 5, 1970; Organisation for the Prohibition of Chemical Weapons (OPCW), Chemical Weapons Convention, 1993; Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, United Nations General Assembly Resolution 2826 (XXVI), United Nations, 1972; Arms Trade Treaty, "Certified True Copy (XXVI-8)," May 2013.

4 Nuclear Suppliers Group, <https://www.nuclearsuppliersgroup.org/index.php/en/>; Missile Technology Control Regime, <www.mtcr.info>; Wassenaar Arrangement, <https://www.wassenaar.org/>; Australia Group, <https://t.ly/M3cq4>; Proliferation Security Initiative, <https://www.psi-online.info/>; World Customs Organization, <https://www.wcoomd.org/>.

technology). Laws and regulations must also apply to re-export, brokering, transshipment, and transit of such items. STC laws and regulations should also enable so-called catch-all controls, requiring authorization for exports of non-listed items under certain circumstances involving proscribed end-uses or end-users, and they should apply throughout the national territory, without carve outs exempting free trade zones from STC requirements.

Control lists represent another fundamental building block of the STC legislative and regulatory foundation. Regulators must create and maintain one or more lists specifying items subject to STC requirements. Ideally, these national control lists should be consistent with those of the CWC, WA, MTCR, NSG, and AG, though they may also include unilaterally controlled items. Many countries around the world achieve this by modeling their national control list(s) on that of the European Union's Dual-Use Export Control Regulation 2021/821, which consolidates the aforementioned lists.[5] Lawmakers must also create a process for maintaining and updating their control lists in a timely manner.

With laws, regulations, and control lists in place, countries must specify their authorization requirements and types of licenses or permits available, as well as any exceptions to or exemptions from those requirements. They must also designate which organizations (see Section 3.1) have various STC responsibilities and establish their precise authorities and mandates. Finally, countries must establish an authorization system to be used for STC administration and coordination mechanisms among the responsible organizations.

1.2 Promote Compliance

Once a STC system requirements are established, countries must promulgate them and enable exporters and importers to comply with them. This requires creation of an outreach program and conducting outreach activities using that program. Ideally, countries will go beyond a one-way promulgation of requirements, fostering instead a true public-private partnership in which industry has input regarding regulatory developments.

1.2.1 Creating an Outreach Program

Creating an outreach program often starts with developing a strategic plan that identifies stakeholders, articulates mission objectives, identifies outreach targets, allocates resources, provides incentives, and defines the outreach mechanisms to employ. Once defined, outreach materials, such as websites, training programs, how-to guides, and self-help tools must be developed and maintained.

1.2.2 Conducting Outreach

One of the most critical steps governments can take to promote compliance is publishing

5 Council Regulation (EC) No. 821/2021 of 20 May 2021 Setting up a Community Regime for the Control of Exports, Transfer, Brokering and Transit of Dual-Use Items (Recast), Official Journal of the European Union, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2021:206:FULL&from=EN>.

the national control lists. Generally, countries also create and maintain one or more websites explaining requirements, providing guidance, explaining the licensing system's processes and procedures, and offering assistance as needed. Some countries go further, organizing seminars or conferences for exporters, or even conducting tailored outreach visits with individual enterprises. Some countries even help enterprises establish or improve their internal compliance programs.

1.2.3 Fostering Public-Private Partnership

Recognizing that informed compliance greatly reduces regulatory burden, many countries go beyond promulgation of requirements to foster constructive government-industry relations, soliciting industry's input regarding regulatory development. This can include creation of advisory councils and use of public comment mechanisms on proposed legislation and regulation. Similarly, regulators can attend industry trade shows to maintain awareness of technology developments and establish relationships with industry representatives.

1.3 Authorize Trade

Traders complying with STC requirements will apply for authorization to conduct regulated trade. The government must process these applications, assess risk, and issue decisions authorizing or denying the applications.

1.3.1 Processing Authorization Applications

Key elements of a standard licensing or permitting process include registration, administrative review for correctness and completeness, commodity classification, verification of authorization requirement, assessment of applicable exceptions and exemptions, and routing to appropriate authorizing organizations.

Registration (either as a business or as an exporter) ensures an enterprise is known and recognized by the government as a legitimate entity. While not required in all countries, registration enables the authorizing organizations to pre-screen each company's credentials and products. It also creates opportunities to conduct outreach to enterprises to enable them to submit appropriate and complete applications.

The application process should receive, log, and track license or permit applications, validate the company's status as an exporter, identify incomplete applications, and support communication with applicants to remedy incomplete applications. Determining if the requested authorization is required entails checking the commodity's classification with respect to the national export control lists, assessing catch-all (end-use/end-user) requirements, and checking whether any available exceptions or exemptions apply. Finally, depending on the outcome of the previous steps, the license application should either be rejected or accepted, and accepted applications should be routed to the appropriate licensing authorities.

1.3.2 Assessing Risk

Licensing authorities approve or deny license applications based on risk assessment. This encompasses analysis of the item(s) to be exported, the credibility of the stated end use, and the reliability of the stated end user. If multiple government agencies conduct their own risk assessments, a process is needed to integrate those assessments, resolve disputes, and identify risk mitigation measures.

1.3.3 Issuing and Communicating Decisions

Based on the risk assessment discussed above, a decision to approve or deny the application must be made and communicated to the applicant. In some cases, these decisions will also be communicated to other government agencies (such as those responsible for enforcement) or international partners (for example, many countries participating in the nonproliferation regime have committed to sharing information with each other regarding license application denials).

1.3.4 Maintaining Oversight

Regulating licit trade also requires certain oversight functions. Commonly, authorized activities must be reported when (or if) they actually take place, and the licensing authorities must review those reports and respond to any activities of concern. Record keeping is another important function needed for oversight purposes to provide transparency, track timeliness of reviews, and support trend analysis. Finally, the system should enable and support administration of appeals.

1.4 Prevent Illicit Trade

The fourth functional area for STC systems is preventing illicit trade, for example, strategic trade contrary to the requirements established, through law enforcement. This requires the ability to detect and interdict illicit trade, conduct investigations, and apply penalties.

1.4.1 Detecting Non-Compliance

Noncompliance with STC requirements is generally detected in real time through targeting of shipments, after the fact by conducting audits, and before the fact by generating investigative leads.

Targeting potentially illicit outbound shipments is generally accomplished by analyzing and screening export declarations in a risk management system, comparing them to risk profiles, and examining high-risk shipments using documentary or physical checks.

Audits of exporting companies entails a structured examination of their internal commercial data, sales contracts, and records to measure compliance and detect non-compliance, which can include failure to declare, false declarations, export without a required export license, or misuse

of an export license. Audits also play a role in implementing a risk management strategy with compliance levels serving as an input to targeting rules. Audits are particularly important with respect to detecting illicit transfers of intangible technology.

Generating investigative leads involves identifying and prioritizing enterprises involved in producing or trading strategic goods and developing relationships with those companies that lead to voluntary disclosure of suspicious enquiries they may receive or other information that may indicate illicit procurement attempts.

1.4.2 Interdicting Illicit Trade

Interdicting illicit shipments requires the ability to detain and inspect shipments, identify the products being exported, and obtain binding licensing determinations establishing whether the shipment required authorization or if it did not conform to the terms of its license. In some cases, interdicting illicit trade requires the ability to recall shipments improperly exported, which in turn can require establishing protocols with carriers or with authorities in other countries.

1.4.3 Conducting Investigations

Investigations of STC violations can be administrative or criminal. Administrative investigations require the ability to obtain an official licensing determination from the appropriate regulatory authority and the ability to issue administrative subpoenas to compel testimony and/or the production of documentary evidence. They also require the use of standard investigatory techniques such as open source research, interviews, and surveillance. Criminal investigations additionally require the ability to obtain and execute search and arrest warrants. Finally, STC investigations often require the ability to conduct international joint investigations.

1.4.4 Imposing Penalties

STC cases can result in administrative penalties, such as fines, consent agreements, designation, de-registration, asset forfeiture, and loss of export privileges. Criminal penalties can include incarceration.

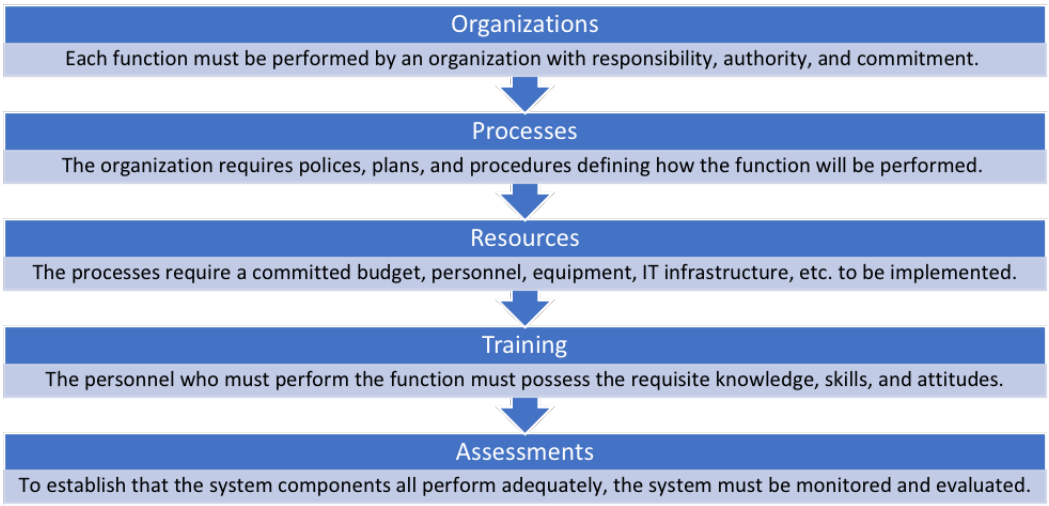
2.0. STC System Components: How STC Systems Work

The STC functions discussed thus far are universal, implemented in one way or another by all STC systems. How a government implements the various functions within its structure and organizations is generally unique for each country and represents its existing governmental structures used to accomplish the STC functions.

Each function must be performed by an organization with specific responsibilities and authorities. Each organization will follow processes to perform the functions, and those processes require resources such as a committed budget, personnel, equipment, and IT infrastructure. The personnel who perform the functions require training bestowing the requisite knowledge,

skills, abilities, and attitudes. Finally, since all systems require feedback to ensure they perform adequately, an assessment strategy is needed to monitor and evaluate the performance of each function. These STC system components -- organizations, processes, resources, training, and assessment -- constitute a government's implementation of its STC system.

Table 2. STC system components



2.1 Organizations

Many functions of a STC system require involvement of multiple government organizations, each with specific responsibilities, authorities, and mandates. Multiple legislative offices and ministries will be involved in implementing the STC system. Each will designate and empower agencies with specific departments, divisions, etc., to implement various STC functions. While some countries create a new agency or department devoted to STC implementation, most STC systems make use of existing organizational structures that perform similar functions.

Table 3. Example ministries and agencies for STC implementation

Ministry	Agency/Department
Prime Minister	National Police Agency Investigative Authority National Security Intelligence Services
Ministry of Defense	Coast Guard Defense Investigative Authority
Ministry of Internal Affairs	Statistics Bureau
Ministry of Trade	Export Licensing Agency Trade Investigative/Audit Authority
Ministry of Finance	Customs Customs Investigative Authority
Ministry of Justice	Justice Investigative Authority Prosecutors

Ministry of Foreign Affairs	Disarmament and Nonproliferation Department
Ministry of Education	Higher Education Bureau

The STC Systems Model can be used as a checklist to ensure each that a designated organization within the government is responsible for each STC function. Careful planning and coordination to identify precisely where in each organization's structure the function will be performed will help minimize conflicts and duplications of authority.

2.2 Processes

Organizations determine how business will be conducted using regulations, orders, policy statements, plans, guidance documents, or procedures. In most governments, once a law is codified the impacted ministries and agencies usually propose and enact implementing regulations. Regulatory requirements help put laws into practice. Ministries and their agencies often have other mechanisms for providing more detailed guidance on how to conduct business in accordance with the laws and regulations. These often take the form of orders, guidance documents, and eventually detailed procedures that instruct staff on how to conduct their work.

2.3 Resources

Performing work requires resources, which generally can be grouped into three broad categories: financial, human, and physical.

- *Financial resources:* Financial resources are arguably most important as a committed budget enables acquiring the other needed resources. Allocating government budget to STC system implementation enables each of the organizations involved to accomplish the functions assigned to them in accordance with the developed regulations and processes. Underfunding individual functions will weaken the STC system.

- *Human resources:* The success of any organization is dependent on the strength and capabilities of its staff. Identifying, recruiting, hiring, and retaining skilled and independent professionals is essential to effective STC system development and implementation. Government staffing organizations need to place talent at all levels within the organizations implementing the STC system.

- *Physical resources:* Personnel performing STC functions require a standard set of business system resources to conduct their work. These include physical spaces, proper office equipment, communication capabilities, and information technology infrastructure. The latter is particularly important as many of the functions of an STC system have time constraints to minimize negative impacts to a nation's trade. Effective and timely implementation of these functions is enabled through dedicated tools built upon and within the IT infrastructure. Ensuring that the IT infrastructure supports collaboration across organizations while also protecting sensitive information warrants special attention.

2.4 Training

Having responsible organizations, detailed processes, and adequate resources will not ensure an effective STC system if the implementing staff do not have the required knowledge, skills, and attitudes to perform their tasks. Like the STC system itself, the training subsystem must have budget, staff, and physical resources to be able to ensure staff receive the training they need to perform their work. These resources include having skilled curriculum developers, trained trainers, and systems to test, certify, and track staff abilities. Most countries do not have a single STC system training program; rather each implementing organization generally has its own training programs into which it incorporates STC-specific training.

2.5 Assessments

Ensuring that any system is operating correctly requires routine and ongoing assessment. Assessments generally involve monitoring and evaluation (M&E) as well as incorporation of feedback from all concerned stakeholders (including regulated entities). Monitoring is the regular collection of information about the work involved. Evaluation is the collection of judgements made concerning a service or task, specifically how efficiently it is working and what areas could be improved.

There are wide variety of tools available for conducting system monitoring, evaluation, and improvement planning. It is essential (whether developing metrics, performing audits, or conducting tabletop exercises) that the relevant functions of the STC system are being assessed. Knowing what success for a function looks like and monitoring and evaluating for that performance measure is core to the assessment. Improvement planning and incorporating of feedback provide recommended changes to the other STC components (organization, processes, resources, and training) for the system to better perform the STC function(s) being assessed.

3.0 STC Systems Model: Combining the What and How

While most descriptions of STC systems are organization focused, in that they describe what a specific or "typical" organization accomplishes within the context of an overall STC system, implementation of STC systems varies widely given differences in government structure, economic focus, and political priority. Existing nominal models do not fit any specific STC system, which make them difficult to apply to specific national circumstances.

By separating the functions STC systems need to accomplish from the specific choices countries make about how to accomplish those functions, this STC Systems Model provides a universal template any country can use to inform, assess, and improve their STC system. This approach enables more consistent assessments of system performance, allows comparisons across systems, and enables a more universal approach to changes and improvements.

Engineering disciplines commonly use failure analysis to determine the root cause of failure with the aim of taking corrective action. Core to failure analysis is understanding what a system is supposed to do and then identifying what system component is not correctly working.

Corrective actions are then planned around changing the system such that it performs its intended functions. Similarly, the STC Systems Model provides a framework to enable partners to systematically examine and assess at the needed level of fidelity, which STC functions need implementation or improvement. For each such identified function, the analysis then looks at the STC components to see what needs to be changed to implement/improve the function. The STC components provide that framework for improvement planning as the relevant changes can be characterized as five basic questions:

1. Is there a responsible organization;
2. Do they have adequate processes and authorities in place;
3. Are the needed resources assigned;
4. Are personell trained to do the job; and
5. Is the function monitored and held accountable to ensure it is working as intended.

All improvements to the system will fall into one of these bins and it is the insights gained from answering these questions that countries can use to develop and implement their improvement plans.

The STC Systems Model provides a framework to achieving shared understanding and agreement about designing, developing, and strengthening STC systems. It also has practical applications for exercises and training designed to test and improve STC implementation. The Model's STC Functions provide relevant exercise scenarios and guide planned discussions while assessment of the system components identifies areas for improvement. With respect to training, the Model's STC Functions form the basis for identifying knowledge, skills, and attitudes needed for a systematic approach to training.

Countries find their own way, within their governmental structures, to effectively implement an STC system. The STC Systems Model organizes what their system is supposed to do while providing a logical approach to identifying and implementing improvements in that system. Despite the wide range of STC system types around the world, all countries can use this model to help guide efforts to strengthen their own STC systems.

Strategic Trade Controls as a Foreign Policy Tool in Strategic Competition: Implications of a Shift Beyond Global Nonproliferation Goals

HYUK KIM AND ROBERT SHAW[1]

Abstract

Over the past decades, strategic trade controls (STC) have undergone significant transformations, with end-use and end-users emerging as primary risk factors in export risk assessment amidst strategic competition. This evolution signifies a paradigm shift from the traditional global nonproliferation goal of STC, which primarily targets non-state actors as stipulated in United Nations Security Council Resolution 1540, towards leveraging STC as an instrument for advancing specific states' national security and foreign policy objectives. This paper delineates three predominant trends characterizing the utilization of end-use/r-based controls by states. Furthermore, it explores the ramifications of these trends for national foreign policy interests and the universality of nonproliferation at the international level.

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Keywords

Strategic trade controls, export controls, nonproliferation, United Nations Security Council Resolution 1540, strategic competition, catch-all controls, 73 FR 49311, military end-use/r controls, Entity List, sanctions on Russia, cybersurveillance, European Union, Export Administration Regulations (EAR), Regulation 821/2021

Background

Economic power, together with military might, is a significant foreign policy instrument in international relations. Economic measures, such as export controls and sanctions, have been convenient alternative tools to military action in advancing states' foreign policy goals.[2] For instance, as the Cold War emerged, Western Bloc countries established the Coordinating Committee for Multilateral Export Controls (COCOM) in order to diminish the Eastern Bloc's military potential by curtailing transfers of sensitive technologies to states comprising the latter.[3] In other words, the export control measures adopted by Western Bloc countries during the Cold War reflected their broader foreign policy objective as they were designed to maintain military superiority *vis-à-vis* the Eastern Bloc for eventual dominance in the international system.

Beyond operating within (or outside of) blocs or regimes, states are capable of aligning their foreign policy goals across the entire international system, when faced with a common enemy that threatens their status as agents of international politics. In this case, states can resort to economic instruments against non-state actors claiming the right to sovereignty or attempting to decentralize the existing international order. For instance, after the September 11 attacks in 2001, Permanent Members of the United Nations Security Council (UNSC) made concerted efforts to encourage states to adopt export control measures to prevent non-state actors from acquiring capabilities of Weapons of Mass Destruction (WMD), which led to the adoption of United Nations Security Council resolution (UNSCR) 1540 in 2004.[4]

During the debates at the UN that accompanied the resolution, a few states expressed concerns about the inadequacy of adopting the draft of UNSCR 1540 at the UNSC. For example, Pakistan claimed that the UNSC is not a representative body of the international community, hence it is not entitled to legislative authority for issues that can be separately addressed by nonproliferation-related institutions.[5] Moreover, implementation and enforcement of the draft resolution could indiscriminately result in coercive actions against state actors instead of the primary target of the draft resolution, non-state actors. Nevertheless, UNSCR 1540 was unanimously adopted by the Security Council as states understood that it was intended to support a largely noncontroversial goal of eliminating threats of acquisition of WMD by non-state actors, with statements of select Security Council members noting a "sense of urgency"

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2 Edward Hallett Carr, "Chapter 8: Power in International Politics," in *The Twenty Years' Crisis, 1919-1939: An Introduction to the Study of International Relations* (New York: Perennial, 2001), p. 132.

3 John H. Henshaw, "The Origins of COCOM: Lessons for Contemporary Proliferation Control Regimes," Stimson Center, May 1993.

4 UN Security Council, Security Council Resolution 1540 (2004), April 28, 2004, S/RES/1540 (2004).

5 UN Security Council, 4950th Meeting, April 22, 2004, S/PV.4950, <https://www.securitycouncilreport.org/un-documents/document/1540-spv-4950.php>.

following the September 11, 2001 attacks.[6] Subsequent extensions of the mandate of the 1540 Committee established by the Resolution, particularly through UNSCR 1977 adopted in 2011, have institutionalized among UN member states the association of strategic trade controls – a key component of the Resolution, per its Operative Paragraph 3(d) – with this specific nonproliferation goal.[7]

Since the adoption of UNSCR 1540, practitioners responsible for strategic trade control policy and its implementation in national contexts have positioned the associated regulatory bodies – those responsible for licensing, outreach, and enforcement -- as serving broader global nonproliferation purposes by minimizing risks of diversion of exported items toward WMD applications by any recipients, including non-state actors. A trade regulatory regime typically operates at the national level by introducing interests from various stakeholders.

From a legal standpoint, regulatory bodies must maintain "effective independence" to carry out their functions without undue influence from other governmental bodies.[8] This independence is crucial, especially when conflicting interests could hinder the regulator's ability to fulfill its duties. However, in many countries, a trade regulatory body is placed within the trade ministry – an organization that promotes economic interests -- and its decision-making process involves inputs from other organizations, such as ministries responsible for foreign affairs and national defense. For instance, the U.S. dual-use trade regulatory body, the Bureau of Industry and Security (BIS) is established under the Department of Commerce, and its decision-making process for export licenses involves inter-agency coordination, encompassing inputs from the Departments of States, Energy, and Defense.

"Effective independence" does not necessarily mean that a regulatory body should be structurally separated from or completely immune from legitimate inputs of other governmental bodies.[9] Specific to the goal of WMD nonproliferation, an inter-agency coordination process instead helps a trade regulator assess potential proliferation risks of transactions in question by introducing views on risks residing in the diplomatic and military dimensions. However, the inclusive nature of the decision-making process in an STC system also opens the possibility for perceived or actual influence from other agencies with competing interests over certain transactions, such as concerns about economic relations with particular states, imperative foreign policy needs, or military competition. When considered in the strict context of UNSCR 1540-specific requirements, if interests not directly related to WMD nonproliferation impact the "effective independence" of the STC regulatory body, the priority of the state's 1540-focused nonproliferation obligations could be altered in the decision-making process.

In the recent global environment of great power competition, specific countries and regions, such as the United States and the European Union, have been adapting select STC regulatory mechanisms previously associated with WMD nonproliferation such as catch-all controls to accommodate other strategic and foreign policy drivers. Presently, these drivers primarily surround the actions of other states, perceived to be strategic competitors or adversaries,

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6 Ibid

7 Security Council Resoultion 1977, United Nations, S/RES/1977(2011), April 20, 2011, <http://unscr.com/en/resolutions/1977>.

8 Carlton Stoiber et al., "Chapter 2: The Regulatory Body," in *Handbook on Nuclear Law: Implementing Legislation* (Vienna: International Atomic Energy Agency, 2010), pp. 25-26, <https://www.iaea.org/publications/8374/handbook-on-nuclear-law-implementing-legislation>.

9 Ibid.

rather than non-state actors as addressed by UNSCR 1540. It is of course a state's sovereign right to decide how to optimize global nonproliferation interests, as represented by the goal of UNSCR 1540, with its foreign policy interests in exercising trade regulatory functions. However, advancing UNSCR 1540 implementation universally across UN member states could be impacted and potentially weakened, as the STC mechanisms now being affected by this development have traditionally been promoted internationally – often by the same states and regions currently altering them -- as best practices associated with the resolution's nonproliferation-focused objectives.

This study explores this development through an examination of three cases involving changes in end-use/r-based controls and catch-all controls within the legal-regulatory frameworks of the United States and the European Union (EU). Implications of this development are then discussed, followed by a set of considerations suggested for states promoting STC best practices in the context of continuing advancement of UNSCR 1540 and its broader nonproliferation objectives.

Trends in STC End-use/r Control Frameworks: Three Cases

As a part of the national STC licensing system, a state establishes jurisdiction over items by allowing its national authority to place items with potential proliferation applications on national control lists. Any cross-border movements of listed goods trigger export license considerations. In the context of UNSCR 1540 and its specific nonproliferation objectives, when conducting a risk assessment of intended exports, a national authority takes into account at least three main factors: WMD potential inherent in the items to be exported, risks of diversion for proliferation purposes by the end-user, and legitimacy of the end-use. Meanwhile, some states restrict cross-border transactions even when they do not involve listed goods, via catch-all controls, to prevent proliferators from diverting non-listed items for WMD purposes. Unlike item-based controls, a risk assessment for catch-all controls is based on more contextual judgments specific to an individual transaction, mainly by considering end-uses or end-users involved rather than proliferation risks inherently associated with the item being exported.[10]

As foreign policy interests beyond nonproliferation objectives have emerged as another essential element in STCs for select jurisdictions, including the U.S. and the European Union, there are at least three trends in the calibration of risk factors within trade control frameworks. First, a state expands the scope of catch-all controls to cover not only entities and individuals of proliferation concern but also those deemed detrimental to national interests. Second, a state establishes a prominent end-user-based control regime to restrict the trade of a particular set of items with entities of foreign policy and military concerns. Third, states introduces a rule to restrain exports of items with potential for end-uses related to a specific foreign policy concern.

Case examples of each of these three trends – all of which notably predate the expansion of STCs by the U.S. and European Union in response to the war in Ukraine -- are examined in this section, setting a framework for discussion of more current developments and their implications.

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10 Richard Cupitt, "Legal Authorities for an Effective Export Control System," United States Department of State, October 2004, <https://2009-2017.state.gov/strategictrade/documents/organization/162001.pdf>.

Table 1. Comparison of frameworks for end-use and end-user controls in the context of convergence between foreign policy interests and global nonproliferation objectives

	Trend 1	Trend 2	Trend 3
Authorization Scheme	End-user controls	Combination of end-user and end-use controls	End-use controls
Target Item	Any items, including non-listed items	Listed items related to foreign policy or national security concerns	Non-listed items with a potential of specific end-uses of foreign policy concerns
Target End-user	Listed entities and individuals of WMD and foreign policy concerns	Listed military end-users and related government entities	Any individuals and entities
Target End-use	A broad range of end-uses harmful to national interests	End-uses related to broad foreign policy and national security concerns	End-uses posing a specific policy concern
Example	U.S. Entity List	U.S. Military End-use/r Controls	EU cyber-surveillance end-use controls

Case 1: The Entity List of the United States

Many international legal and political instruments highlight catch-all controls as an important best practice in multilateral nonproliferation efforts. In 1996, members of the Australia Group (AG) began to discuss catch-all controls at its plenary session.[11] In 2003, the Wassenaar Arrangement (WA) adopted the "Statement of Understanding on Control of Non-Listed Dual-Use Items" in which the Participating States pledged to control exports of non-listed items to destinations under binding and non-binding arms embargoes if there is a risk of diversion for military end-use.[12] Moreover, Operative Paragraph 3(d) of UNSCR 1540 requires UN Member States to establish end-user-based controls to thwart proliferation efforts by non-state actors.[13]

11 "BIS Annual Report – FY 1996," Bureau of Industry and Security (BIS), April 2014, <https://www.bis.doc.gov/index.php/documents/policy-guidance/930-bis-annual-report-fy-1996/>.

12 "Wassenaar Arrangement – Statement of Understanding on Control of Non-Listed Dual-Use Items", Wassenaar Arrangement document uploaded on the website of the Stockholm International Peace Research Institute (SIPRI), <https://www.sipri.org/node/2857>.

13 UN Security Council, Security Council Resolution 1540 (2004), April 28, 2004, S/RES/1540 (2004).

In the case of the United States, contemporary catch-all controls have been a part of the U.S. export control system since the 1990s. In 1991, the U.S. launched the Enhanced Proliferation Control Initiative (EPCI) to strengthen the controls over transactions with potential proliferation risks of chemical and biological weapons and missiles. According to the EPCI rules, an exporter should have obtained approval from the U.S. Department of Commerce if they were informed by the agency or had knowledge that an intended export of any item would contribute to WMD proliferation (inclusive of missiles as delivery systems).[14]

To enhance the implementation of catch-all controls, the U.S. created in 1997 a list of end-users, called the Entity List, that played an informative function in determining license requirements. The Entity List, in this early iteration, identified foreign individuals and entities known to engage in WMD proliferation activities, mainly covering those from Israel, India, China, Russia, and Pakistan. Any transactions involving entities listed on the Entity List necessitated export license requirements for exporters, regardless of whether the item being exported was on the Commerce Control List (CCL). Around this time, the main factors for the Department of Commerce to consider in its decision-making process for export authorization were WMD nonproliferation-related elements, such as a stated end-use, the significance of an item for proliferation purposes, and the nonproliferation track record of the destination.[15]

Since the middle of the 2000s, U.S. foreign policy and national security interests have begun to emerge in this domain traditionally associated with WMD nonproliferation-focused controls. Specifically, the BIS issued a rule, "Authorization To Impose License Requirements for Exports or Reexports to Entities Acting Contrary to the National Security or Foreign Policy Interests of the United States" (73 FR 49311) in August 2008.[16] 73 FR 49311 expands the scope of catch-all controls from a nonproliferation focus to broader U.S. foreign policy objectives by revising criteria used to guide adding an entity to the Entity List to include the entity's involvement in activities detrimental to U.S. national security and foreign policy interests, based on "specific and articulable facts."[17] Since then, an inter-agency process for making a decision on any changes to the Entity List, called the End-User Review Committee (ERC), has included representatives from government offices serving broad U.S. foreign policy interests, such as the Departments

14 "BIS Annual Report – FY 1996," Bureau of Industry and Security (BIS), April 2014, <https://www.bis.doc.gov/index.php/documents/policy-guidance/930-bis-annual-report-fy-1996/>.

15 "BIS Annual Report – FY 1997", Bureau of Industry and Security (BIS), April 2014, <https://www.bis.doc.gov/index.php/documents/policy-guidance/929-bis-annual-report-fy-1997/file>.

16 "Authorization To Impose License Requirements for Exports or Reexports to Entities Acting Contrary to the National Security or Foreign Policy Interests of the United States," 73 FR 49311, Federal Register, August 21, 2008, <https://www.federalregister.gov/documents/2008/08/21/E8-19102/authorization-to-impose-license-requirements-for-exports-or-reexports-to-entities-acting-contrary-to>.

17 Part 744.11 (b), the Export Administration Regulations of the United States, Bureau of Industry and Security (BIS), November 17, 2023, <https://www.bis.doc.gov/index.php/documents/regulations-docs/2343-part-744-control-policy-end-user-and-end-use-based-2/file>.

of State, Defense, and Energy with potential extension to Treasury.[18,19,20]

The introduction of the new rule, 73 FR 49311, was met with resistance from U.S. industry due to concerns about a potential adverse impact on the national economy. For example, according to a report from the Department of in 2015, a U.S. company operating in the biometric sector voiced concerns that foreign policy-based export controls, especially potential restrictions on biometric devices and equipment to China, could potentially stifle growth in the sector. The company argued that the policy was not substantiated by evidence linking these items to crime control or human rights abuses in China.[21] However, the U.S. government maintained that the foreign policy benefits derived from the new rule outweighed the potential economic cost to the U.S industries.[22]

In addition, the U.S. government concluded in 2008 that the potential adverse impact of 73 FR 49311 on the U.S. economy was not significant. According to the Congressional Review Act (CRA), a U.S. federal agency should submit a report on their rule-making activities to the U.S. Congress before the proposed rule can take effect.[23] The report should identify whether the proposed rule is a "major" rule against which the economic criterion, "an annual effect on the economy of $100 million or more," is applied.[24] The Office of Management and Budget (OMB), responsible for such determination, did not categorize 73 FR 49311 as a "major" rule.[25]

Meanwhile, the U.S. government finds at least three benefits from implementing this adjustment to the Entity List, including trade facilitation, legal flexibility, and user convenience. First, the rule enabled the U.S. to advance its national security and foreign policy interests without disrupting legitimate trade. Instead of imposing a broad country-wide license requirement, the government could still facilitate trade with countries where entities and individuals of concern are located. For example, Suzhou Keda Technology, based in South Korea, has been on the

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18 "Authorization To Impose License Requirements for Exports or Reexports to Entities Acting Contrary to the National Security or Foreign Policy Interests of the United States," 73 FR 49311, Federal Register, August 21, 2008, <https://www.federalregister.gov/documents/2008/08/21/E8-19102/authorization-to-impose-license-requirements-for-exports-or-reexports-to-entities-acting-contrary-to>.

19 "Control Policy: End-User and End-Use Based," 744.16 (d), Export Administration Regulations, November 17, 2023, <https://www.bis.doc.gov/index.php/documents/regulations-docs/2343-part-744-control-policy-end-user-and-end-use-based-2/file>.

20 "Licensing Best Practices: EAR License Application Processing and Issuance," Presentation material by the U.S. Department of Commerce, 2017, <https://www.bis.doc.gov/index.php/documents/update-2017/2129-what-are-they-thinking-the-interagency-licensing-process-best-practices-bis-mr/file>.

21 "2015 Report on Foreign Policy-Based Export Controls," U.S. Department of Commerce, 2015, <https://www.bis.doc.gov/index.php/documents/pdfs/1285-bis-foreign-policy-report-2015-1/file>.

22 Ibid.

23 "The Congressional Review Act (CRA): Frequently Asked Questions," Congressional Research Service, November 12, 2021, <https://sgp.fas.org/crs/misc/R43992.pdf>.

24 "Summary of the Congressional Review Act," U.S. Environmental Protection Agency, <https://www.epa.gov/laws-regulations/summary-congressional-review-act>.

25 "Authorization To Impose License Requirements for Exports or Reexports to Entities Acting Contrary to the National Security or Foreign Policy Interests of the United States," 73 FR 49311, Federal Register, August 21, 2008, <https://www.federalregister.gov/documents/2008/08/21/E8-19102/authorization-to-impose-license-requirements-for-exports-or-reexports-to-entities-acting-contrary-to>.

U.S. Entity List for its suspected involvement in human rights abuses in Xinjiang, China, since July 2021.[26] Nevertheless, the U.S. categorizes South Korea as a Group B destination to which less restrictive controls are applied for the trade of a particular set of items.[27,28]

Second, 73 FR 49311 has simplified the rule-making process by removing the need to issue general orders to impose restrictions on entities outside the nonproliferation domain. Prior to issuing 73 FR 49311, BIS had to undergo *ad hoc* legal procedures to issue general orders to make parties of national security concern subject to the EAR. For example, BIS issued General Order 3 to impose restrictions on entities potentially involved in terrorism in September 2006. Those entities include Mayrow General Trading and its related entities involved in procuring electronic components for improvised explosive devices (IEDs) that were eventually used against the U.S.-led forces in Iraq and Afghanistan.[29] Since the U.S. Export Administration Regulations (EAR) specify "supporting persons engaged in acts of terror" as an illustrative example contrary to U.S. national security and foreign policy interests, Mayrow-like cases no longer require BIS to issue additional general orders to impose restrictions on entities of concern.[30] As General Order 3 was no longer needed due to 73 FR 49311, the Order was rescinded in September 2008.[31]

Lastly, 73 FR 49311 enabled BIS to consolidate the multiple lists of entities of concern into a single list to enhance public capacity to identify export license requirements. Without a broader set of criteria, BIS had to place entities harming U.S. national security and foreign policy interests on a separate list, Supplement No. 1 to part 736, from the Entity List. 73 FR 49311 allowed BIS to incorporate 115 entities on Supplement No. 1 to part 736 into the Entity List.[32] As a single consolidated list, the Entity List, could provide exporters operating within U.S. Department of Commerce BIS jurisdiction with the convenience of screening end-users against

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26 "Addition of Certain Entities to the Entity List; Revision of Existing Entry on the Entity List; Removal of Entity From the Unverified List; and Addition of Entity to the Military End-User (MEU) List," 86 FR 36496, Federal Register, July 21, 2021, <https://www.federalregister.gov/documents/2021/07/12/2021-14656/addition-of-certain-entities-to-the-entity-list-revision-of-existing-entry-on-the-entity-list>.

27 "Supplement No. 4 to Part 744 - Entity List," Export Administration Regulation (EAR), Bureau of Industry and Security (BIS), May 19, 2023, <https://www.bis.doc.gov/index.php/documents/regulations-docs/2347-744-supp-4-6/file>.

28 "Supplement No. 1 to Part 740," Export Administration Regulation (EAR), Bureau of Industry and Security (BIS), September 2022, <https://bis.doc.gov/index.php/documents/regulation-docs/2255-supplement-no-1-to-part-740-country-groups-1/file>.

29 "Addition of Certain Persons to the Entity List; Removal of General Order From the Export Administration Regulations (EAR)," 73 FR 54499, Federal Register, September 22, 2008, <https://www.federalregister.gov/documents/2008/09/22/E8-22088/addition-of-certain-persons-to-the-entity-list-removal-of-general-order-from-the-export>.

30 "Control Policy: End-User and End-Use Based," 744.16 (d), Export Administration Regulations, November 17, 2023, <https://www.bis.doc.gov/index.php/documents/regulations-docs/2343-part-744-control-policy-end-user-and-end-use-based-2/file>.

31 "Addition of Certain Persons to the Entity List; Removal of General Order From the Export Administration Regulations (EAR)," 73 FR 54499, Federal Register, September 22, 2008, <https://www.federalregister.gov/documents/2008/09/22/E8-22088/addition-of-certain-persons-to-the-entity-list-removal-of-general-order-from-the-export>.

32 Ibid.

one BIS-administered list as opposed to multiple lists.[33]

In September 2009, BIS expanded the scope of controlled activities applicable to the Entity List by issuing 74 FR 35797. Before this rule, the trade restrictions on parties on the Entity List had only been applied to export and re-export transactions. The new rule expanded the scope of controls by subjecting transfer (in-country) to the EAR. According to part 734.16 of the EAR, transfer (in-country) means "a change in end-use and end-user of an item within the same foreign country."[34] By expanding the scope of controlled activities involving parties identified on the Entity List, the U.S. government could have a wider window to review transactions involving entities of concern, which advances the U.S. government's foreign policy interests by reducing risks of diversion of any U.S. items to entities of concern.[35]

Since the 2010s, the implementation of end-user-based controls by the U.S. has featured highly adjustable and calibrated configurations reflecting foreign policy objectives, and actual enforcement cases and state-level trends in end-user-based export license denials confirm that they are not merely theoretical constructs. The case of listing the Chinese telecommunication company ZTE on the Entity List and then adjusting the scope of licensing requirements and license exceptions amidst an emerging trade dispute and deepening strategic competition exemplifies such trends.[36] The ZTE case shows how the U.S. operated the end-user controls to change the company's behavior by utilizing temporary general licenses and denial orders in conjunction with the Entity List.

Specifically, the U.S. government had begun investigations into the allegations that ZTE made significant amounts of exports of the U.S.-origin telecommunication items to North Korea and Iran and placed ZTE on the Entity List in March 2013.[37] As per ZTE's request to delist them from the Entity List, BIS issued a temporary general license specific to ZTE that suspended the effect of the license requirements pertaining to transactions involving parties on the Entity List.[38] The U.S. government stated that it is within its discretion to determine renewing the

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33 "Authorization To Impose License Requirements for Exports or Reexports to Entities Acting Contrary to the National Security or Foreign Policy Interests of the United States," 73 FR 49311, Federal Register, August 21, 2008, <https://www.federalregister.gov/documents/2008/08/21/E8-19102/authorization-to-impose-license-requirements-for-exports-or-reexports-to-entities-acting-contrary-to>.

34 "Control Policy: End-User and End-Use Based," 744.16 (d), Export Administration Regulations, November 17, 2023, <https://www.bis.doc.gov/index.php/documents/regulations-docs/2343-part-744-control-policy-end-user-and-end-use-based-2/file>.

35 "Revisions to Certain End-User Controls Under the Export Administration Regulations; Clarification Regarding License Requirements for Transfers (in-country) to Persons Listed on the Entity List," 74 FR 45990, Federal Register, September 8, 2009, <https://www.federalregister.gov/documents/2009/09/08/E9-21367/revisions-to-certain-end-user-controls-under-the-export-administration-regulations-clarification>.

36 "China's ZTE May be First Major Casualty of Trade War with U.S.," *The Guardian*, May 10, 2018.

37 "Additions to the Entity List," 81 FR 12004, Federal Register, March 8, 2016, <https://www.federalregister.gov/documents/2016/03/08/2016-05104/additions-to-the-entity-list>. Although the investigation focused on alleged diversion to North Korea and Iran, notably the addition of ZTE to the Entity List referenced Part 744.11, which is reserved for entities "acting contrary to the national security or foreign policy interests of the United States," as opposed to the WMD nonproliferation-specific Parts 744.2, 744.3 and 744.4.

38 "Temporary General License," 81 FR 15633, Federal Register, March 24, 2016, <https://www.federalregister.gov/documents/2016/03/24/2016-06689/temporary-general-license>.

license, contingent on ZTE's subsequent behavior.[39]

In March 2016, ZTE pled guilty and concluded a settlement agreement with BIS in which the company agreed to a total of USD $1.1 billion dollars combining civil and criminal penalties and a seven-year probationary period.[40] During the probationary period, ZTE had to conduct active compliance activities, while the BIS suspended the denial of export privileges to ZTE in return.[41] The ERC of BIS decided to remove ZTE from the Entity List on March 29, 2017, given ZTE's cooperation with the settlement.[42]

However, in 2018 BIS learned that ZTE failed to meet its compliance requirements by paying bonuses to the employees involved in the illegal transactions instead of subjecting them to disciplinary actions during the probationary period.[43] As a result, ZTE lost its export privileges and access to items subject to the EAR as BIS placed ZTE on the Denied Persons List in April 2018.[44,45] The failure to comply with the settlement by ZTE led to another settlement agreement with the U.S. government. The Superseding Settlement Order issued in June 2018 imposed an additional USD $1.5 billion dollars on ZTE as civil penalties and required ZTE to maintain a Special Compliance Coordinator (SCC) operated in coordination with the BIS with an extended probation period of ten years. BIS eventually delisted ZTE from the Denied Persons List following the settlement.[46]

BIS describes the period of FY 2018-20 as active years when they utilized the Entity List as an essential tool to maintain U.S. national security and foreign policy interests.[47,48,49] In addition to ZTE, there were a number of Chinese entities newly added to the Entity List during a period of heightened strategic and military competition as well as trade disputes with China. For

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39 Ibid

40 83 FR 17644, Federal Register, April 23, 2018, <https://www.federalregister.gov/documents/2018/04/23/2018-08354/in-the-matter-of-zhongxing-telecommunications-equipment-corporation-zte-plaza-keji-road-south>.

41 "BIS Annual Report – FY 2017," Bureau of Industry and Security (BIS), <https://www.bis.doc.gov/index.php/documents/policy-guidance/2366-bis-annual-report-fy-2017/file>.

42 "Removal of Certain Persons From the Entity List; Addition of a Person to the Entity List; and EAR Conforming Change," 82 FR 15458, Federal Register, March 29, 2017, <https://www.federalregister.gov/documents/2017/03/29/2017-06227/removal-of-certain-persons-from-the-entity-list-addition-of-a-person-to-the-entity-list-and-ear>.

43 "BIS Annual Report – FY 2018," Bureau of Industry and Security (BIS), <https://www.bis.doc.gov/index.php/documents/pdfs/2401-2018-bis-annual-report/file>.

44 "General Prohibitions," Part 736.3 (a)(2), Export Administration Regulations, November 17, 2023, <https://www.bis.doc.gov/index.php/documents/regulation-docs/413-part-736-general-prohibitions/file>.

45 "BIS Annual Report – FY 2018," Bureau of Industry and Security (BIS), <https://www.bis.doc.gov/index.php/documents/pdfs/2401-2018-bis-annual-report/file>.

46 Ibid

47 "BIS Annual Report – FY 2019", Bureau of Industry and Security (BIS), <https://www.bis.doc.gov/index.php/documents/pdfs/2540-bis-annual-report-2019/file>.

48 "BIS Annual Report – FY 2020", Bureau of Industry and Security (BIS), <https://www.bis.doc.gov/index.php/documents/pdfs/2711-2020-bis-annual-report-final/file>.

49 "BIS Annual Report – FY 2018," Bureau of Industry and Security (BIS), <https://www.bis.doc.gov/index.php/documents/pdfs/2401-2018-bis-annual-report/file>.

example, BIS listed Huawei Technologies and its 114 non-U.S. affiliates on the Entity List upon 13 counts of U.S. law violations in FY 2019, followed by an additional 38 Huawei-related parties listed in FY 2020.[50,51] According to BIS, the ZTE case illustrates the U.S. government's intent to establish a precedent to promote compliance with U.S. regulations and rectify the behaviors of the concerned entity.[52] This suggests how the U.S. has been adapting what was initially a nonproliferation-focused STC mechanism supporting informed catch-all to serve a broader array of foreign policy objectives, based on the particulars of the entity, its behavior, and policy concerns behind the entity's listing on the Entity List in recent years.

Case 2: Military End-Use and End-User Controls of the United States

In 2007, the U.S. government stated its national policy to facilitate legitimate civilian trade with China while preventing U.S. items from contributing to the PRC's military capabilities. Toward that end, BIS issued 72 FR 33646 to introduce a new export authorization scheme focusing on military end-use within the regulatory framework for dual-use export controls. The rule's intent is to make certain groups of items subject to military end-use controls, ensure that importers in China do not divert those items for military purposes, and facilitate legitimate trade with China.[53]

In terms of target items, there are two sets of items affected by 72 FR 33646. First, the rule requires export authorization from BIS for the export of any items listed on the CCL for national security (NS) reasons. If exports of those items contribute to the PRC's military capabilities, BIS will deny such exports. In addition, BIS set a new license requirement for items under 31 export control classification categories that had been eligible to be exported to China without a license prior to the adoption of the new rule. An export license is required if an exporter knows or has a reason to know the intended export of such items to China would be destined for military end-uses.[54]

Second, 72 FR 33646 introduces a requirement for obtaining an End-User Certificate (EUC) from the Ministry of Commerce of China (MOFCOM) to ensure no diversion toward military ends while facilitating trade with China. The EUC requirement supports the implementation of an understanding on end-use verification agreed upon between the U.S. and China in 2004. BIS initially proposed USD $5,000 as a threshold amount that requires an EUC in 2006. However, after receiving public comments, BIS decided to raise the proposed amount to USD $50,000 to minimize the potential increase in cases subject to the end-use verification agreement so that

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50 "BIS Annual Report – FY 2019", Bureau of Industry and Security (BIS), <https://www.bis.doc.gov/index.php/documents/pdfs/2540-bis-annual-report-2019/file>.

51 "BIS Annual Report – FY 2020", Bureau of Industry and Security (BIS), <https://www.bis.doc.gov/index.php/documents/pdfs/2711-2020-bis-annual-report-final/file>.

52 "BIS Annual Report – FY 2018," Bureau of Industry and Security (BIS), <https://www.bis.doc.gov/index.php/documents/pdfs/2401-2018-bis-annual-report/file>.

53 "Revisions and Clarification of Export and Reexport Controls for the People's Republic of China (PRC); New Authorization Validated End-User; Revision of Import Certificate and PRC End-User Statement Requirements," 72 FR 33646, Federal Register, June 19, 2007, <https://www.federalregister.gov/documents/2007/06/19/E7-11588/revisions-and-clarification-of-export-and-reexport-controls-for-the-peoples-republic-of-china-prc>.

54 Ibid.

trade of a less significant amount with China could be facilitated without an EUC.[55]

Third, 72 FR 33646 granted BIS the authority to publish a Validated End-User (VEU) list to facilitate trade with Chinese entities posing minimal U.S. national security concerns. The VEU enumerates entities to which the export of eligible items does not trigger a license requirement. To list a certain end-user on the VEU, an inter-agency committee led by BIS assesses the entity's eligibility by considering multiple factors. Those factors include the entity's solid track record of supporting exclusively civilian sectors, compliance with U.S. export controls, cooperation with the U.S. government in compliance measures, and relations with U.S. companies. The destination's nonproliferation status is also a criterion for listing on the VEU.[56]

Since 2014, the U.S. has expanded the scope of the military end-use control scheme to serve broader foreign policy interests by targeting more countries of concern for various foreign policy reasons and introducing end-user-based controls. In September 2014, BIS issued 79 FR 55608, which places ten Russian entities on the Entity List in response to the occupation of Crimea in Ukraine. In addition, 79 FR 55608 imposes license requirements based not only on knowledge of military end-use but also on that of military end-users to which Chinese military-related entities also became subject in 2020.[57,58] A few months later, BIS introduced another rule to extend the applications of military-focused controls to Venezuela given alleged human rights abuses and the hindrance of the democratization process by the Venezuelan military regime.[59]

In 2021, the military-focused authorizations scheme was extended to cover Myanmar as a reaction to the military coup that occurred in the country in the same year. Myanmar had been under strict U.S. trade embargoes since the Clinton administration in 1997 due to lagging progress toward democratization. As the democratically elected government was established in Myanmar, the BIS terminated these restrictions on the country and moved it from Group D:1 to Group B in 2016. Group B means "countries raising few national security concerns" while Group D:1 indicates "countries raising national security concerns."[60] In other words, the relocation of Myanmar in Country Groups around the democratization period represents the US government's evaluation that Myanmar no longer poses an impediment to U.S. foreign

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55 Ibid

56 "Revisions and Clarification of Export and Reexport Controls for the People's Republic of China (PRC); New Authorization Validated End-User," 71 FR 38313, Federal Register, November 3, 2006, <https://www.federalregister.gov/documents/2006/07/06/E6-10504/revisions-and-clarification-of-export-and-reexport-controls-for-the-peoples-republic-of-china-prc>.

57 "Russian Sanctions: Addition of Persons to the Entity List and Restrictions on Certain Military End-Uses and Military End-Users," 79 FR 55608, Federal Register, September 17, 2014, <https://www.federalregister.gov/documents/2014/09/17/2014-22207/russian-sanctions-addition-of-persons-to-the-entity-list-and-restrictions-on-certain-military-end>.

58 "Expansion of Export, Reexport, and Transfer (In-Country) Controls for Military End-Use or Military End-Users in the People's Republic of China, Russia, or Venezuela; Correction," 85 FR 34306, Federal Register, June 29, 2020, <https://www.federalregister.gov/documents/2020/06/03/2020-09717/expansion-of-export-reexport-and-transfer-in-country-controls-for-military-end-use-or-military-end>.

59 "Venezuela: Implementation of Certain Military End Uses and End Users License Requirements Under the Export Administration Regulations," 79 FR 66288, Federal Register, November 7, 2014, <https://www.federalregister.gov/documents/2014/11/07/2014-26465/venezuela-implementation-of-certain-military-end-uses-and-end-users-license-requirements-under-the>.

60 "Burma: Implementation of Sanctions," 86 FR 13173, Federal Register, March 8, 2021, <https://www.federalregister.gov/documents/2021/03/08/2021-04745/burma-implementation-of-sanctions>.

policy interests, so more lenient trade regulations are applicable.[61,62,63,64] However, the military coup in 2021 led to the U.S. unilateral sanctions that have placed Myanmar under the military end-use and end-user controls and repositioned the country to Group D:1.[65]

In sum, the U.S. military end-use and end-user control development trajectory reflects the government's perception of and reaction to varying international circumstances. As the great power competition with China became entrenched, the U.S. created a sub-regime targeting military end-use within what was previously a largely nonproliferation-focused end-use/r control framework, to impede its competitor's military advancement. In reaction to events destabilizing other regions, such as Russia's occupation of Crimea, the U.S. expanded the military-focused control regime to cover military end-users to restore regional stability. As seen in the Myanmar case, the U.S. operation of the military targeting authorization scheme presented the government's responsiveness to the changes in the country's governance system. The U.S. has flexibly implemented its catch-all and end-use/r control framework to deal with foreign policy issues (inclusive of national security, strategic stability, and political realities) extending beyond nonproliferation, which in the era when the EPCI was introduced had served as the primary driver of catch-all and end-use/r controls.

Case 3: European Union Cyber-Surveillance End-Use Catch-all Controls

The European Union's export control system is a regional-level system with requirements that apply to all EU Member States. The EU system, when contrasted with the U.S. system, is a comparatively young system – having formed with the launch of Regulation 428/2009 in 2009. The EU system arguably had, at its foundation, WMD nonproliferation as a core policy driver.[66] However, in recent years, other transnational foreign policies and security concerns appear to have at least joined WMD nonproliferation as one of the key focus areas of EU export controls – particularly in the context of catch-all controls to address end-uses.

Specifically, the introduction of the EU's export control Regulation 428/2009 included a clear articulation of nonproliferation-focused catch-all controls via its Article 4, which required exporters to apply for a license in advance of an export if the exporter has been informed by national authorities or is aware that the item to be exported will be used "with the

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61 "Burma: Amendment of the Export Administration Regulations Consistent With an Executive Order That Terminated US Government's Sanctions," 81 FR 94962, Federal Register, December 27, 2016, <https://www.federalregister.gov/documents/2016/12/27/2016-31208/burma-amendment-of-the-export-administration-regulations-consistent-with-an-executive-order-that>.

62 "Shipments of Limited Value," Part 740.3, the Export Administration Regulations, December 8, 2023, < https://www.bis.doc.gov/index.php/documents/regulations-docs/2341-740-2/file>.

63 "Shipments of To Group B Countries (GBS)," Part 740.4, the Export Administration Regulations, December 8, 2023, < https://www.bis.doc.gov/index.php/documents/regulations-docs/2341-740-2/file>.

64 "Technology and Software under Restriction," Part 740.6, the Export Administration Regulations, December 8, 2023, < https://www.bis.doc.gov/index.php/documents/regulations-docs/2341-740-2/file>.

65 "Burma: Implementation of Sanctions," 86 FR 13173, Federal Register, March 8, 2021, <https://www.federalregister.gov/documents/2021/03/08/2021-04745/burma-implementation-of-sanctions>.

66 Council Regulation (EC) No. 428/2009 of 5 May 2009 Setting up a Community Regime for the Control of Exports, Transfer, Brokering and Transit of Dual-Use Items, Official Journal of the European Union (L 134/1) of May 29, 2009. See in particular paragraphs (3), (14), and (15) of the preamble.

development, production, handling, operation, maintenance, storage, detection, identification or dissemination of chemical, biological or nuclear weapons or other nuclear explosive devices or the development, production, maintenance or storage of missiles capable of delivering such weapons."[67] In this regard, the WMD nonproliferation objectives were the most significant policy driver for the advent of the EU STC system.

Shortly after the introduction of Regulation 428/2009, efforts to update and reform the EU STC system introduced policy debate and recommendations on strengthening the implementation of catch-all controls and, importantly, expanding them to address human rights concerns.[68] Specifically, the EU Parliament's recommendation in October 2012 states that catch-all controls should be expanded to include end-use-based restrictions on exports of cyber-surveillance items if likely to contribute to human rights abuses in the destination country.[69] Although this recommendation was not immediately adopted, it ultimately paved the way for an expansion of the scope of catch-all controls in 2021 via the introduction of the successor to Regulation 428/2009: EU Regulation 821/2021 published on June 11, 2011, also referred to as "the Recast."

The preamble of the Recast explicitly specifies that one of the objectives of the Regulation is to ensure that the EU Member States take into account foreign policy considerations, especially human rights, in its implementation. In particular, Article 5 of the Recast exemplifies the EU's efforts to address specific human rights concerns through the nonproliferation-driven framework. The Article imposes catch-all controls on EU exporters "if the exporter has been informed by the competent authority that the items in question… may be intended… for use in connection with internal repression and/or the commission of serious violations of human rights and international humanitarian law."[70] Moreover, Article 9, albeit with hortatory nature, specifies that it is EU Member States' discretion to establish requirements for catch-all controls for public security and broad human rights reasons.[71] As a result, any non-listed items with the potential of having cyber-surveillance end-uses and possible extension to broader human rights abuses have become subject to what has been a traditionally nonproliferation-focused export control mechanism (catch-all).

The recent developments in the EU STC system show how the nonproliferation framework could be recalibrated to address specific foreign policy concerns. Unlike the unilateral initiatives of the U.S. export control system, the EU system may have a narrower window for flexibility and responsiveness to the contemporary international environment. It is because

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67 Article 4, Council Regulation (EC) No. 428/2009 of 5 May 2009 Setting up a Community Regime for the Control of Exports, Transfer, Brokering and Transit of Dual-Use Items, Official Journal of the European Union (L 134/1) of May 29, 2009.

68 "Green Paper: The Dual-Use Export Control System of the European Union: Ensuring Security and Competitiveness in a Changing World," Publication Office of the European Union, 30 June 2011, <https://op.europa.eu/en/publication-detail/-/publication/e320e5f5-b204-47c6-9989-928a653a5e52/language-en>.

69 "Community regime for the control of exports, transfer, brokering and transit of dual-use items," European Parliament legislative resolution of 23 October 2012 on the proposal for a regulation of the European Parliament and of the Council amending Regulation (EC) No 428/2009 setting up a Community regime for the control of exports, transfer, brokering and transit of dual-use items (COM(2011)0704 – C7-0395/2011 – 2011/0310(COD)) (2014/C 68 E/25), Official Journal of the European Union, July 3, 2014.

70 Article 5, Council Regulation (EC) No. 821/2021 of 20 May 2021 Setting up a Community Regime for the Control of Exports, Transfer, Brokering and Transit of Dual-Use Items (Recast), Official Journal of the European Union, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2021:206:FULL&from=EN>.

71 Ibid, Article 9.

the EU Regulation establishes a regional-level system that should represent the common interests of dozens of states. Observers also note that the Recast contains less ambitious foreign policy-driven requirements than the European Commission initially proposed, as the cyber-surveillance catch-all obligation is the only mandatory foreign policy-related clause in the Regulation.[72] However, the cyber-surveillance catch-all controls clearly illustrate how the EU's initially WMD-focused regulatory system has evolved to support other foreign policy concerns of like-minded countries.

Continuation of Trends in STC End-Use/r Controls

The three cases examined in the prior section all featured expansion of catch-all controls or end-use/r controls either informing catch-all controls or with "catch-all"-like characteristics – which, since the 1990s and through the institutionalization of UNSCR 1540, had been associated with WMD nonproliferation objectives – to address other foreign policy objectives. Notably, each of the three cases preceded the war in Ukraine of 2022, and the introduction of additional end-use/r-focused strategic trade controls by the U.S., EU, and other like-minded states in response. In the era of great power competition, the U.S. and like-minded countries may find foreign policy-driven end-use and end-user controls palatable in advancing their political goals by targeting specific countries or entities of concern that pose common threats to their national interests. Recent developments in the international environment, such as the onset of military conflict in Ukraine in 2022, have further accelerated the tendency of states to promote national and foreign policy interests through frameworks traditionally focused on nonproliferation. Between 2022 and 2023, the U.S. incrementally adopted sets of heavy sanctions measures on Russia, such as expanded licensing requirements for dual-use items, a luxury goods ban, industry sanctions targeting oil and gas sectors, and asset freezes of Russian officials. The license requirement revisions to EAR in particular corroborates how the U.S. is adapting end-use/r-focused STC's to accommodate strategic interests against its strategic competitor, Russia.

On March 22, 2022, BIS published a new rule, 87 FR 12226 (effective since February 24, 2022), to impose sanctions measures on Russia in response to the conflict in Ukraine. The rule explicitly states that its purpose is to protect U.S. national security and foreign policy interests by limiting Russia's access to U.S.-origin items that could contribute to its military capability. To that end, BIS introduced several end-user-focused measures, such as expanding the scope of Russian military end-user controls and introducing a new Foreign Direct Product (FDP) Rule concerning Russian military end-users.[73]

Specifically, 87 FR 12226 removed 45 Russian entities from the Military End-User (MEU) List and placed them on the Entity List.[74] As previously stated, the military-focused control scheme targets specific items transferred to concerned end-uses. Meanwhile, the Entity List

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72 Chiara Klaui, Kevin J. Wolf, Daniel Lund & Isabel Foster, "EU Publishes the Recast Regulation," AG Data Dive, Akin Gump, Strauss Hauer & Feld LLP, June 11, 2011, <https://www.akingump.com/en/experience/practices/cybersecurity-privacy-and-data-protection/ag-data-dive/eu-publishes-the-recast-regulation.html>.

73 "Implementation of Sanctions Against Russia Under the Export Administration Regulations (EAR)," 87 FR 12226, Federal Register, March 3, 2022, <https://www.federalregister.gov/documents/2022/03/03/2022-04300/implementation-of-sanctions-against-russia-under-the-export-administration-regulations-ear>.

74 Ibid.

restricts the trade of any items subject to the EAR if destined to listed entities. Therefore, relocating Russian entities from the MEU List to the Entity List has expanded the scope of controlled items applicable to Russian military end-user controls. This is a particularly important observation because 73 FR 49311 of 2008, as noted previously, equips BIS with legal flexibility and responsiveness to international environments by allowing it to modify the Entity List for broader foreign policy objectives beyond nonproliferation purposes.

In addition, the Russian military FDP rule allows the U.S. to leverage its economic and political influence over global trade with Russia. According to the military FDP rule, any items that are direct products of U.S.-origin technology or were produced by facilities that involve U.S. equipment or technology at large are subject to the EAR.[75] In other words, foreign exporters should consider the FDP requirements when they know that their FDP-applicable items are destined for Russian military end-users, even if those are indigenously produced. Meanwhile, the FDP rule introduced a "Russia Exclusion List," which enumerates countries that joined efforts to implement the sanctions on Russia and made license exceptions for the FDP rule available to those U.S. strategic partners.[76]

Similar FDP rules have been deployed to address U.S. strategic concerns surrounding China's potential access to advanced semiconductor production technologies and the benefits this would afford the PRC's military capabilities. Introduced and augmented in a series of new rules from 2020 to 2022, this further application of the FDP rule followed expansions of the Entity List to include several China-based entities identified by the U.S. government as linked to the country's military-civil fusion strategy.[77] Notably, these expansions included the addition of Huawei Technologies and over 150 affiliates to the Entity List across 2019 to 2020, including those involved in semiconductor development.[78] On October 7, 2022, via a new rule, the U.S. BIS further expanded the scope of FDP-related licensing requirements specific to select end-uses and end-users in China.[79] Some observers have argued that this suite of actions, accentuated by the deployment of the rule on October 7, 2022, has constituted a game-changing development in U.S.-China strategic competition.[80] This is particularly striking given that, until these recent expansions of FDP rules, the EAR featured only one FDP rule, which was generally applied to re-exports and not widely known beyond the domain of regulators and industry compliance practitioners.

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75 Ibid.

76 "Countries Excluded from Certain License Requirements," Supplement No.3 to Part 746, Export Administration Regulations (EAR), <https://www.bis.doc.gov/index.php/documents/regulation-docs/420-part-746-embargoes-and-other-special-controls/file>.

77 "Foreign Direct Product Rule Guidance," Barnes / Richardson Global Trade Law, January 11, 2021, <https://www.barnesrichardson.com/foreign-direct-product-rule-guidance>.

78 Lauren Feiner, "U.S. Tightens Restrictions on Huawei Access to Technology and Chips," CNBC, August 17, 2020, <https://www.cnbc.com/2020/08/17/us-to-tighten-restrictions-on-huawei-access-to-technology-chips-sources-say.html>.

79 Sylwia A. Lis, Frank Pan, Eunkyung Kim Shin, and Caroline Howard, "BIS Issues New Export Controls Targeting China's Advanced Computing and Semiconductor Sectors," Baker McKenzie Global Sanctions and Export Controls Blog, October 24, 2022, <https://sanctionsnews.bakermckenzie.com/bis-issues-new-export-controls-targeting-chinas-advanced-computing-and-semiconductor-sectors/>.

80 Gregory Allen, "Choking Off China's Access to the Future of AI," Center for Strategic and International Studies (CSIS), October 11, 2022.

Whether these developments constitute a longer-term trend in the use of nonproliferation-legacy catch-all and end-use/r controls may ultimately depend on the U.S. government's perception of their effectiveness. At this point, it is premature and beyond the scope of this study to make a definitive judgment on the efficacy of foreign policy-driven export controls in achieving national foreign policy objectives. The U.S. government has not yet made a deterministic assessment of the effectiveness of these recent measures, although the Secretary of Commerce commented in 2018 that the foreign policy-driven export controls employing the Entity List was "likely to achieve the intended foreign policy (and national security) purposes".[81] However, as discussed above, the basis for establishing foreign policy-driven controls within the nonproliferation framework has helped the U.S. respond promptly to specific events posing imminent threats and may have facilitated aligning strategic interests among partners. These trends appear posed to continue and develop further in the context of ongoing great power competition, as seen in the U.S.-EU Trade and Technology Council (TTC) launched in 2021 to promote broad economic and foreign policy interests through trade-related cooperation among the partners, including export controls.[82,83] As such, examining their implications – particularly for the original WMD nonproliferation applications of the end-use/r controls discussed here – is especially timely, as this can inform policy considerations with respect to promotion of STC best practices and, more broadly, nonproliferation goals in support of UNSCR 1540.

Conclusion

This trend of expanding application of catch-all and related end-use/r control mechanisms previously associated with nonproliferation goals to include foreign policy objectives carries implications for strategic trade controls and their promotion internationally. First, in U.S. and EU jurisdictional contexts particularly, end-use/r-based licensing requirements are positioned to become more institutionalized as a central focus of STC policy and implementation, on par with the position enjoyed by control list-based licensing since the Cold War-era. This in turn will likely increase awareness of end-use/r controls among private-sector international trade communities – particularly exporters subject to U.S. and EU jurisdictions (including U.S. extraterritorial jurisdiction via U.S. re-export controls and the FDP rule) – as well as governments actively considering development or augmentation of STC frameworks. By extension, this may increase awareness of WMD nonproliferation-focused catch-all controls. Additionally, on a technical level, nonproliferation-specific catch-all controls could themselves absorb innovations associated with highly configurable, context-dependent foreign policy-based military or human rights-focused end-use/r controls.

At the same time, however, this trends carries the risk that, in a UNSCR 1540 best practices context, catch-all and end-use/r controls will become increasingly associated with national-level strategic and foreign policy objectives rather than WMD nonproliferation as a transnational

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81 "2018 Report on Foreign Policy-based Export Controls," Bureau of Industry and Security, United States Department of Commerce, 2018, <https://www.bis.doc.gov/index.php/documents/pdfs/2186-bis-foregin-policy-report-2018/file>.

82 "Request for Public Comments on Supply Chain Issues To Support the U.S.-EU Trade and Technology Council Secure Supply Chains Working Group," 87 FR 19854, Federal Register, April 6, 2022, <https://www.federalregister.gov/documents/2022/04/06/2022-07211/request-for-public-comments-on-supply-chain-issues-to-support-the-us-eu-trade-and-technology-council>.

83 "U.S.-E.U. Trade and Technology Council (TTC)," Office of the United States Trade Representative, <https://ustr.gov/useuttc>.

goal. As a result, beyond the U.S., EU, and like-minded states with strategic concerns regarding the military capabilities of Russia and China, enthusiasm among UN member states for adopting new or implementing existing end-use/r controls may wane. This is because such controls may be seen less as a component of Operative Paragraph 3(d) of nonproliferation-focused UNSCR 1540 and more a feature of great power competition. Indications of increased ambivalence toward such controls may already be visible in other multilateral fora, outside of the UN.

For instance, at the Plenary meeting of the Wassenaar Arrangement (WA) in 2003, some member states expressed that they would not implement military end-use controls targeting China.[84] Moreover, according to one of the authors' discussions with an anonymous diplomat at a strategic trade control capacity-building event in 2022, it would be difficult for her/his country to implement STCs that incorporate military end-user controls or human rights elements since the country prefers to address those issues at more inclusive and multilateral venues, such as the UN.[85]

As discussed in the introduction, controversy surrounding UNSCR 1540 in its early years, such as the method of its introduction and the potential costs of its obligations portended for UN member states, left the resolution's future status uncertain – at least until the introduction of UNSCR1977, which extended the mandate of the 1540 Committee by ten years. If end-use/r controls, as a key component of the resolution's Operative Paragraph 3(d), become associated with other less universal but strategic goals of particular states, broad international support for strategic trade controls overall or even UNSCR 1540 itself could weaken over time. This in turn raises questions on how best to promote catch-all and end-use/r controls in a UNSCR1540 context and the broader aim of WMD nonproliferation – particularly when the leading providers of international STC capacity-building assistance, the U.S. and the EU, are also at the forefront of this trend of applying such controls to other, more national-level foreign policy goals.

The expanded use of catch-all and end-use/r controls to support other national-level foreign policy objectives suggests a need for new considerations with respect to UNSCR 1540-related implementation of these mechanisms of nonproliferation STCs. With policymakers and practitioners tasked with advancing the implementation of UNSCR 1540 in mind, a set of possible considerations are highlighted below – all informed by the implications of this trend, as discussed above:

1. A thorough assessment of the impact and effectiveness of new end-use/r controls, driven by foreign policy goals other than nonproliferation, would have value for nonproliferation policy as well. Such an assessment would aim to identify possible innovations that could be beneficial if adapted for use by nonproliferation-specific catch-all and end-use/r control mechanisms.

2. When promoting STC best practices, particularly the U.S. and EU as state providers of capacity–building assistance, should consider distinguishing those catch-all and end-use/r controls with: a) a military end-use/r or human rights policy focus, vs. b) those

84 "Revisions and Clarification of Export and Reexport Controls for the People's Republic of China (PRC); New Authorization Validated End-User; Revision of Import Certificate and PRC End-User Statement Requirements," 72 FR 33646, Federal Register, June 19, 2007, <https://www.federalregister.gov/documents/2007/06/19/E7-11588/revisions-and-clarification-of-export-and-reexport-controls-for-the-peoples-republic-of-china-prc>.

85 The author's interview with a diplomat who prefers to remain anonymous was conducted in June 2022.

with a nonproliferation focus, specific to the context of UNSCR1540. Separate capacity-building programming for each focus area might be needed to ensure that UNSCR1540-driven programming features b) rather than a) above and is not seen as promoting unrelated, national-level strategic interests.

3. In support of 2) above, states actively adopting end-use/r controls with foreign policy drivers other than nonproliferation may need to consider making the specific control mechanisms – particularly use of restricted party lists – more distinguishable in their national system. As a good practice, since the early 2010s, the U.S. government has maintained a Consolidated Screening List (CSL) tool for use by exporters and other businesses that combines multiple restricted entity lists, inclusive of those operated by distinct agencies (e.g., – Department of Commerce, Department of Treasury, etc.). When an entity listed on the Entity List is searched for and found on the CSL, the tool will produce a profile of the entity that includes a reference to the specific end-use/r control provision of the Export Administration Regulations that guided the entity's listing. With an understanding of which end-use/r control provisions are associated with WMD nonproliferation goals specifically, a practitioner using the CSL can confirm whether the listing of the entity on the Entity List was for nonproliferation reasons or due to other U.S. national security or foreign policy concerns. The CSL tool is widely used beyond the U.S. and introduced as a reference tool for export risk assessment material in many STC outreach training programs. The provision of specific contexts for additions within this single list could help the international STC and nonproliferation community more accurately identify WMD proliferation-specific risks in transactions in question, as opposed to risks strictly related to the U.S.' own national security and foreign policy objectives. With improvements to available search options, a nonproliferation-specific list could potentially be generated by the CSL tool, without a need for regulatory changes – and therefore referenced more readily as a national-level best practices example in an UNSCR1540 capacity-building context. This would also increase visibility of WMD nonproliferation, as a prioritized objective, among exporters.

The Sino-U.S. Technology Cold War: How the U.S. Leverages Technology Advantages through Economic Statecraft

SCOTT A. JONES

Abstract

This article explores the dynamics of the Sino-U.S. technology Cold War, focusing on how the U.S. leverages its technological advantages through economic statecraft. It delves into China's technology acquisition strategies, including instances of economic espionage and the theft of trade secrets, within the context of China's national priorities like the Made in China 2025 initiative. The U.S. response involves a mix of export controls, sanctions, and foreign direct investment controls aimed at preserving its technological lead, particularly in "chokepoint" technologies like jet engines and semiconductors. The efficacy of these technology controls over time is also examined, highlighting the complex interplay of economic engagement, strategic competition, and national security concerns shaping the bilateral relationship.

Keywords

Strategic competition, economic security, export controls, foreign direct investment (FDI) screening, China, United States, emerging technologies, sanctions

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Introduction

Made in China 2025 – the Chinese government's signature technology development plan – identifies developing domestic dynamic random-access memory (DRAM) and aerospace technology as a national priority. In September 2018, a Chinese state-owned enterprise was implicated in a conspiracy to commit economic espionage through the theft of stolen trade secrets from a U.S. semiconductor company. The target U.S. company is a global leader in the semiconductor industry and specializes in dynamic random-access memory (DRAM).[1] Later that same year, a Chinese Ministry of State Security (MSS) officer was arrested and charged with economic espionage involving the theft of trade secrets for civilian and military aircraft technology related to engineering services and signature material, jet engines, and aircraft propulsion, and engine containment structures from leading U.S. aviation firms.[2]

These two cases illustrate a larger, ongoing trend about the nature of technology acquisition by China. They also represent the paradoxical dynamics within the larger Sino-American relationship, one defined by economic interdependence and increasingly antagonistic political currents. Since the normalization of relations in 1979, Washington has sought simultaneously to maximize economic engagement while selectively controlling the export of strategic and military-related technology. The U.S. believed that through economic engagement, China's anti-capitalist and anti-Western posture (more specifically that of the Chinese Communist Party (CCP)) would moderate. Recently, U.S. National Security Advisor Jake Sullivan declared such China engagement a failure, asserting that:

> "*[m]uch of the international economic policy of the last few decades has relied upon the premise that economic integration would make nations more responsible and open and that the global order would be more peaceful and cooperative, that bringing countries into the rules-based order would incentivize them to adhere to its rules. It didn't turn out that way. In some cases it did, and in lot of cases it did not.*"[3]

The new era maintains and intensifies many of the former strategic approaches to Chinese military development. For decades, Washington has deployed export controls as the primary

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1 See "PRC State-Owned Company, Taiwan Company, and Three Individuals Charged with Economic Espionage," U.S. Department of Justice, November 1, 2018 and "U.S. DOD: Military And Security Developments Involving The People's Republic Of China 2011-2020 Annual Report To Congress," Office of the Secretary of Defense, May 2019.

2 See "Chinese Intelligence Officers and their Recruited Hackers and Insiders Conspired to Steal Sensitive Commercial Aviation and Technological Data for Years," U.S. Department of Justice, October 30, 2018.

3 Remarks by National Security Advisor Jake Sullivan on Renewing American Economic Leadership at the Brookings Institution, April 27, 2023. The White House's 2022 National Security Strategy asserts that, "The most pressing strategic challenge facing our vision is from powers that layer authoritarian governance with a revisionist foreign policy. It is their behavior that poses a challenge to international peace and stability—especially waging or preparing for wars of aggression, actively undermining the democratic political processes of other countries, leveraging technology and supply chains for coercion and repression, and exporting an illiberal model of international order. Many non-democracies join the world's democracies in forswearing these behaviors. Unfortunately, Russia and the People's Republic of China (PRC) do not."

means to limit Chinese acquisition of military and dual-use technologies. In recent years, the U.S. has added sanctions to the mix and expanded controls over foreign direct investment (FDI) to restrict technology access. Moving forward, an intensification and full deployment of tools of "economic statecraft," particularly in the domain of emerging or "innovation" technology, can be expected.[4] Indeed, the current trajectory of Sino-American relations is increasingly described as a "tech war," where the national security narrative is defined both by traditional military assets and high technology prowess.[5] The policy tools in this conflict are economic in nature and have rapidly expanded in scope and application during the Trump and Biden administrations.[6]

In this article, the author will review the current tools of economic statecraft arrayed against China in its efforts to acquire U.S.-origin high technology. Subsequent sections will examine export controls, sanctions, and foreign direct investment controls. The penultimate section will survey "chokepoint" technologies over which the U.S. exercises a commanding lead: jet engine and semiconductor manufacturing. The concluding section will examine the efficacy of technology controls over time.

Controlling Technology

Since the dawn of the Cold War, U.S. national security strategy has arguably hinged upon military technical superiority: the ability to field and maintain advanced military assets one or two generations ahead of any adversary. Export controls – policy instruments designed to facilitate and control trade in military and dual-use items – are fundamental to this end through technology acquisition denial. Globalization, the economic rise of China, and changing military and defense doctrines required the evolution in and deployment of the policy tools of economic

4 The focus on "innovation" and emerging technologies animates the Pentagon's current, third, Offset Strategy, as a means to "assure U.S. military superiority." See "Deputy Secretary: Third Offset Strategy Bolsters America's Military Deterrence, Office of the Secretary of Defense," October 31, 2016. See also, Paul McLeary, "The Pentagon's Third Offset May Be Dead, But No One Knows What Comes Next: Experts Say the U.S. Advantage over China and Russia is Eroding," *Foreign Affairs*, December 18, 2017, <https://foreignpolicy.com/2017/12/18/the-pentagons-third-offset-may-be-dead-but-no-one-knows-what-comes-next/>.

5 There is a growing body of literature describing the current Sino-U.S. geopolitical contest in explicitly technology-centric terms. See for example, Caitlin Lee, "Winning the Tech Cold War," RAND, August 17, 2023; Riley Callanan, "US-China Tech "Cold War" is On," *GZero*, The Eurasia Group, June 2, 2023; and Adam Segal, "The Coming Tech Cold War with China," *Foreign Affairs*, September 9, 2020, <https://www.foreignaffairs.com/articles/north-america/2020-09-09/coming-tech-cold-war-china>.

6 Some analysts maintain that we are in a new era of global politics, one best described as "geoeconomics." See for example, Robert D. Blackwill and Jennifer M. Harris, *War by Other Means: Geoeconomics and Statecraft* (Cambridge, MA: Harvard University Press, 2016). Also see Mikael Wigell, "Conceptualizing Regional Powers' Geoeconomic Strategies: Neo-Imperialism, Neo- Mercantilism, Hegemony, and Liberal Institutionalism," *Asia Europe Journal*, Vol. 14, Issue 2 (2016), p. 135.

statecraft.[7] This broader suite of controls includes and combines export controls, FDI national security reviews, and sanctions, much of which is currently focused on China's Military-Civil Fusion (MCF) policy and broader state-led high technology development efforts.[8]

Export Controls: Lists and Regulatory Innovation

The modern U.S. export control system began with the enactment of the *Export Control Act of 1949* (ECA) and the establishment of the Coordinating Committee on Multilateral Export Controls (COCOM) that same year.[9] The singular focus of both systems was to curtail Soviet and Chinese Communist acquisition of military, nuclear, and dual-use items and technologies that could be used to advance their respective military capabilities.[10] The initial list structure for both U.S. and multilateral systems was identical save for the inclusion of additional items

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7 The broader deployment of economic policy to achieve strategic ends was explicitly referenced in the 2017 National Security Strategy: "Economic tools—including sanctions, anti-money-laundering and anti-corruption measures, and enforcement actions—can be important parts of broader strategies to deter, coerce, and constrain adversaries." National Security Strategy of the United States of America, December 2017, <https://trumpwhitehouse.archives.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf>, p. 42.

8 As noted in a C4ADS report on China's defense industrial policy, "[At] its core, MCF is a domestic strategy to catalyze resource sharing between the civilian and military spheres to build a modern defense industrial complex. Among the goals stated in the MCF five-year plan is "mutual open sharing of basic science and technology (S&T) resources" and "effective two-way technology transfer." Essentially, it aims to open China's defense markets to a broad pool of civilian participants in order to benefit from existing policies designed to stimulate innovation in the civilian industrial base." See Marcel Angliviel de la Beaumelle, Ben Spevack, and Devin Thorne, "Open Arms: Evaluating Global Exposure to China's Defense-Industrial Base," C4ADS, October 2019. For additional context on how MCF is attempting to integrate the civilian industrial base and defense economy and other goals, see for example the full text of Tai Ming Cheung, "13th Five-Year Plan for the Integration of Civilian and Military," in *Forging China's Military Might: A New Framework for Assessing Innovation* (Baltimore: Johns Hopkins University Press, 2014); and "Hearing on What Keeps Xi Up at Night: Beijing's Internal and External Challenges," Testimony of Greg Levesque before the U.S.-China Economic and Security Review Commission, 2019.

9 The ECA was preceded by the *Export Control Act of 1940*, which authorized the President to license or prohibit the export of "essential defense materials." The ECA of 1949, however, was the first peacetime export control regime and amended in 1951, 1953, 1956, 1958, 1960, 1962, and 1965. While the short supply ethos of the earlier Act animated the 1949 Act, national security became the dominant rationale. With regards to the ECA of 1949, "[p]robably no single piece of legislation gives more power to the President to control American commerce." See Harold J. Berman and John R. Garson, "United States Export Controls—Past, Present, and Future," *Columbia Law Review*, Vol. 67, Issue 5 (May 1967), pp. 791–890 as quoted in Richard T. Cupitt, *Reluctant Champions: U.S. Presidential Policy and Strategic Export Controls* (Routledge: New York, 2000).

10 As an adjunct to COCOM and in response to Chinese involvement in the Korean War, the United State petitioned for the creation of a separate committee, CHINCOM, to multilaterally control exports to communist China in 1952. Export controls by CHINCOM were considerably more restrictive and corresponding lists more expansive than controls by COCOM, which became known as the "China Differential." In 1957, however, U.S. allies formally incorporated CHINCOM into COCOM. For more information on CHINCOM, see, among others, Frank Cain, "The U.S.-Led Trade Embargo on China: The Origins of CHINCOM, 1947–1952," *Journal of Strategic Studies*, Vol. 18 (1995), pp. 33–54 and Hugo Meijer, *Trading with the Enemy: The Making of US Export Control Policy toward the People's Republic of China* (Oxford: Oxford University Press, 2016). See also Scott Jones, "Think Twice Before Bringing Back the COCOM Export Control Regime," *Defense News*, April 9, 2021.

on the lists (e.g., unilateral controls). The size and content of the control lists were subject to constant debate within the U.S. and between NATO allies, a characteristic that persists into current export control deliberations.[11] Arguably, the less complicated and relatively static parts of the lists – nuclear and directly military-related items – were uncontroversial. The bourgeoning dual-use list, by its very nature, roiled consensus-building efforts on establishing control parameters.[12]

As understood during the Cold War, "military superiority" was a concept relative to the Communist Bloc countries and to the Soviet Union in particular. Military superiority was also predicated on conventional weapons as opposed to Weapons of Mass Destruction (WMD), a distinction codified in law and in conceptual practice.[13] Indeed, with the exception of the Atomic List, COCOM controls were almost entirely focused on conventional weapons items and technologies.[14] With the end of the Cold War, the primacy of military superiority as the *raison d'etre* of export control policy became diffuse and subordinate to nonproliferation. As Richard Cupitt observes:

> *"In the summer of 1990, the United States finally appeared ready to abandon anti-Soviet containment as the basis for export controls. Critics pestered the Bush administration to formulate a new rationale for export controls, but none emerged. As some pundits pondered 'the end of history,' concerns about another military threat, the proliferation of weapons of mass destruction and their means of delivery, became ever more prominent."*[15]

In tandem with the collapse of the Soviet threat, the U.S. national security establishment became acutely aware of the rapid rate of "technology-leveling" occurring throughout the global

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11 The dynamic nature of export controls figured prominently in policy tensions between the U.S. Executive and Legislative branches. The complex policy interplay between control list parameters and associated policy guidelines also extended to debates within and between Executive agencies. The canonical review of this export control "policy entrepreneurism" can be found in Richard T. Cupitt, *Reluctant Champions: U.S. Presidential Policy and Strategic Export Controls* (Routledge: New York, 2000).

12 Michael Mastanduno, *Economic Containment: CoCom and the Politics of East-West Trade* (Ithanca: Cornell University Press, 1992). See also Major Rand Lewis, "COCOM: An International Attempt to Control Technology," *Defense Institute of Security Assistance Management (DISAM) Journal*, Vol. 13, Issue 1, Fall 1990, pp. 66-73.

13 See for example, Michael T. Klare, "Endless Military Superiority," *The Nation*, June 27, 2002, <https://www.thenation.com/article/archive/endless-military-superiority/>.

14 As noted by Evans, "Throughout CoCom's existence, the lists of controlled items were modified at least every few years, both to reflect new technological advances and the political/economic balance participating states—mainly the U.S.—were trying to reach. Most of these changes were made to the Industrial List." Samuel Weiss Evans, "Revising Control Lists," Flemish Peace Research Institute, March 2014, pp. 17-18.

15 Richard T. Cupitt, *Reluctant Champions: U.S. Presidential Policy and Strategic Export Controls* (Routledge: New York, 2000), p. 121.

economy as a technology-trade-investment virtuous cycle restructured international markets.[16] As noted in a 1999 Defense Science Board study on globalization and U.S. technological superiority:

> *"The strategic significance of global military-technological leveling cannot be overstated. It presents a direct challenge to perhaps the (emphasis in original) fundamental, if subliminal, assumption underlying the modern—and certainly post-Cold War—concept of U.S. military superiority: that the United States enjoys disproportionately greater access to advanced technology than its potential adversaries."*[17]

Hence, the U.S. export control system is increasingly focused on denying technology more so than the by-products of technology. In 2022, National Security Advisor Jake Sullivan articulated the new calculus for technology control:

> *"On export controls, we have to revisit the longstanding premise of maintaining "relative" advantages over competitors in certain key technologies. We previously maintained a "sliding scale" approach that said we need to stay only a couple of generations ahead. That is not the strategic environment we are in today. Given the foundational nature of certain technologies, such as advanced logic and memory chips, we must maintain as large of a lead as possible."*[18]

The rapid economic and, by extension, military rise of China throughout the early 2000s resuscitated the earlier Soviet-era concept of conventional military superiority.[19] As during the Cold War, the logic of deterrence constrained bilateral nuclear threat dynamics. Under the guide

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16 For example, as economist Richard Baldwin notes: "Managerial and technical know-how became more internationally mobile. After all, the offshored stages of production had to mesh seamlessly and evolve in tandem with the rest of the production network. This 'technology lending' – which is very different from the 1970s 'technology transfer' – could create advanced manufacturing activity in a developing nation in a matter of months. Developing nations no longer had to follow Korea's decade-long slog up the value chain (a feat that dozens of developing nations tried and failed before the 2nd unbundling)." Richard Baldwin, "Trade and Industrialization After Globalization's 2nd Unbundling: How Building and Joining A Supply Chain Are Different and Why It Matters," NBER Working Paper No. 17716, Issued in December 2011, Revised in January 2013, <https://www.nber.org/papers/w17716>, p. 6.

17 "Final Report of the Defense Science Board Task Force on Globalization and Security," Office of the Under Secretary of Defense for Acquisition and Technology, December 1999, p. 29.

18 Remarks by National Security Advisor Jake Sullivan at the Special Competitive Studies Project Global Emerging Technologies Summit, September 16, 2022, <https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/09/16/remarks-by-national-security-advisor-jake-sullivan-at-the-special-competitive-studies-project-global-emerging-technologies-summit/>.

19 The re-emergence of "great power competition" with Russia and, more pointedly, China has impacted the national security narrative regarding export controls, which had earlier focused on WMD and anti-terrorism. For example, a recent Congressional Research Service report contends that: "The shift to renewed great power competition has profoundly changed the conversation about U.S. defense issues from what it was prior to 2014, leading to a reduced relative emphasis in the conversation on counterterrorist operations (although such operations continue), and to a new or renewed emphasis in the conversation on … maintaining U.S. technological superiority in conventional weapons…" See, Renewed Great Power Competition: Implications for Defense—Issues for Congress," Congressional Research Service, R43838, November 7, 2019, p. 6.

of "military-civil fusion," the People's Liberation Army (PLA) modernization is therefore the central threat, complicated by a bourgeoning awareness of the potentially revolutionary impact of so-called "disruptive technologies" such as artificial intelligence, additive manufacturing (e.g., 3D printing), and quantum computing.[20,21] Originally a business school concept, disruptive or exponential technologies were soon adopted by national security strategists. For example, in a Center for a New American Security report, Ben FitzGerald and Shawn Brimley defined disruptive technology in the defense sector as "a technology or a set of technologies applied to a relevant problem in a manner that radically alters the symmetry of military power between competitors" which then "immediately outdates the policies, doctrines and organization of all actors."[22] The focus on "innovation" and emerging technologies animates the Pentagon's current, third Offset Strategy, as a means to "assure U.S. military superiority."[23]

The National Defense Authorization Act for Fiscal Year 2019 repealed the portion of the Export Administration Act (EAA) of 1979 that mandated the creation and maintenance of the Military Critical Technologies List (MCTL). In December 2018, the U.S. Department of Defense cancelled the related DOD Instruction 3020.46, thereby officially terminating the MCTP.[24] As part of the 2019 NDAA, Congress enacted the Export Control Reform Act of 2018 (ECRA). Section 1758 of ECRA instructs that:

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20 See Elsa B. Kania and Lorand Laskai, "Myths and Realities of China's Military-Civil Fusion Strategy," Center for a New American Security (CNAS), January 28, 202, < https://www.cnas.org/publications/reports/myths-and-realities-of-chinas-military-civil-fusion-strategy>.

21 The theory of disruptive innovation was first developed by Clayton Christensen of Harvard Business School in his book, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (1997). Dr. Christensen used the term to describe innovations that create new markets by discovering new categories of customers. They do this partly by harnessing new technologies, but also by developing new business models and exploiting old technologies in new ways. See Clayton Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Harvard Business Review Press, New Haven: 1997). See also Klaus Schwab, "The Fourth Industrial Revolution: What it Means, How to Respond," World Economic Forum, January 14, 2016 and James Manyika et al, *Disruptive Technologies: Advances that Will Transform Life, Business, and the Global Economy*, McKinsey Global Institute, May 2013, p. 6.

22 Ben FitzGerald and Shawn Brimley, "Game Changers: Disruptive Technology and U.S. Defense Strategy," Center for a New American Security (CNAS), September 2013, p. 11. See also Jennifer J. Snow, "Entering the Matrix: The Challenge of Regulating Radical Leveling Technologies," Monterey: Naval Post Graduate School, 2015, p. 5.

23 See "Deputy Secretary: Third Offset Strategy Bolsters America's Military Deterrence," U.S. Department of Defense, October 31, 2016. See also Paul McLeary, "The Pentagon's Third Offset May Be Dead, But No One Knows What Comes Next," *Foreign Affairs*, December 18, 2017.

24 "This Instruction, under the authority of DoD Directive 5134.01 (Reference (a)), establishes policy, assigns responsibilities, and prescribes procedures for developing and maintaining the MCTL as initially mandated by section 2401 et seq. of title 50, United States Code (also known as the Export Administration Act of 1979) (Reference (b)), and extended via section 1701 et seq. of Reference (b) (the International Economic Emergency Powers Act). This Instruction applies to OSD, the Military Departments, the Office of the Chairman of the Joint Chiefs of Staff and the Joint Staff, the Combatant Commands, the Defense Agencies, the DoD Field Activities, and all other organizational entities of the Department of Defense." See The Military Critical Technologies List, Department of Defense Instruction, October 15, 2018, <https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/302046p.pdf?ver=2018-10-24-091538-257>.

> *"The President shall establish and, in coordination with the Secretary, the Secretary of Defense, the Secretary of Energy, the Secretary of State, and the heads of other Federal agencies as appropriate, lead, a regular, ongoing interagency process to identify emerging and foundational (emphasis added) technologies that— (A) are essential to the national security of the United States; and (B) are not critical technologies described in clauses (i) through (v) of section 721(a)(6)(A) of the Defense Production Act of 1950, as amended by section 1703."*

The "critical technologies" not otherwise captured in the new designations include current military, nuclear, and dual-use controls and are emblematic of the new trajectory for export controls: technology.[25]

In the context of the passage of ECRA, it is noteworthy that Congress had been unable to reauthorize the lapsed EAA (2001) to enact new dual-use export control legislation for nearly twenty-years.[26] The rapid techno-industrial rise of China – particularly its Made in China 2025 industrial policy – at last galvanized and concentrated collective Congressional attention to dramatically reorient U.S. export and foreign direct investment controls.[27] The addition of emerging and foundational technologies strongly suggested that the extant military and dual-

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25 As defined in the NDAA, critical technologies consist of the following: "(a) Defense articles or defense services included on the United States Munitions List set forth in the International Traffic in Arms Regulations (ITAR) (22 CFR parts 120-130). (b) Items included on the Commerce Control List set forth in Supplement No. 1 to part 774 of the Export Administration Regulations (EAR) (15 CFR parts 730-774) and controlled: (1) Pursuant to multilateral regimes, including for reasons relating to national security, chemical and biological weapons proliferation, nuclear nonproliferation, or missile technology; or (2) For reasons relating to regional stability or surreptitious listening. (c) Specially designed and prepared nuclear equipment, parts and components, materials, software, and technology covered by 10 CFR part 810 (relating to assistance to foreign atomic energy activities). (d) Nuclear facilities, equipment, and material covered by 10 CFR part 110 (relating to export and import of nuclear equipment and material). (e) Select agents and toxins covered by 7 CFR part 331, 9 CFR part 121, or 42 CFR part 73. (f) Emerging and foundational technologies controlled pursuant to section 1758 of the Export Control Reform Act of 2018."

26 See Ian Fergusson and Paul Kerr, "The U.S. Export Control System and the Export Control Reform Initiative," Congressional Research Service, March 2019, R41916. See also "Prepared Remarks of The Honorable Kevin J. Wolf: Modernizing Export Controls: Protecting Cutting-Edge Technology and U.S. National Security," U.S. House Committee on Foreign Affairs," March 14, 2018. Wolf notes: "applaud the members for addressing this issue [ECRA]. Many of the threats and technologies are very different now than they were in 1979 and the issue warrants evaluation more frequently than every 40 years."

27 In terms of investment controls, the NDAA included the Foreign Investment Risk Review Modernization Act (FIRRMA). FIRRMA reforms the Committee on Foreign Investment in the United States (CFIUS) process currently used to evaluate and address national security-related concerns related to foreign investment into the United States. FIRRMA's most substantial change was to the scope of "covered transactions," which defines much of CFIUS's jurisdiction, to include "critical technologies." As defined in ECRA, critical technologies include "emerging and foundational technologies."

use lists were insufficient to safeguard U.S. national security and assure military superiority.[28] Although ECRA does not define "national security," a request for comment BIS published in November 2018 described the national security concerns to be addressed by the effort, e.g., to identify now uncontrolled items that "have potential conventional weapons, intelligence collection, weapons of mass destruction, or terrorist applications, or [that] could provide the United States with a qualitative military or intelligence advantage."[29]

On 19 November 2018, BIS published an Advanced Notice of Proposed Rulemaking (ANPRM) seeking public comment on criteria for identifying emerging technologies, with an ANPRM for foundational technologies published in 2020. The 2018 ANPRM included fourteen broad representative categories of technology, including illustrative subcategories, from which BIS seeks to determine whether if and which emerging technologies are important to U.S. national security for which effective export controls should be implemented:

1. Biotechnology
2. Artificial intelligence (AI) and machine learning
3. Position, Navigation, and Timing technology
4. Microprocessor technology
5. Advanced computing technology
6. Data analytics technology
7. Quantum information and sensing technology
8. Logistics technology
9. Additive manufacturing (e.g., 3D printing)
10. Robotics
11. Brain-computer interfaces
12. Hypersonics
13. Advanced materials
14. Advanced surveillance technologies

The ANPRM also included a list of explanatory examples of emerging technologies for each category (e.g., computer vision and national language processing within the AI and machine learning category). The ANPRM noted that the definitional process would need to be ongoing through continued interagency and private sector outreach, such as the Emerging Technology

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28 The catalyzing effect of Chinese "Civil-Military Fusion" efforts cannot be underestimated. In particular, a seminal study, the "DIUx Report," analyzed the rapid rate at which the Chinese government sought to acquire and invest in emerging technologies, while at the same noting "DoD does not currently have agreed-upon emerging technologies the U.S. must protect although there has been extensive work on export controls to protect technology products from being shipped to U.S. adversaries." See Michael Brown and Pavneet Singh, "China's Technology Transfer Strategy: How Chinese Investments in Emerging Technology Enable a Strategic Competitor to Access the Crown Jewels of U.S. Innovation," Defense Innovation Unit Experimental (DIUx), updated 2016 and 2017, and January 2018, p. 15.

29 The expansion of the scope of U.S. export controls coincides with efforts to apply them to other policy domains. For example, one analyst recently noted: "There are growing calls in Washington to further expand the use of export controls as an economic tool—helping maintain America's technological edge generally, and not simply in the military domain." See Peter Harrell, "Export Controls Are Bigger and Broader. But Are We Safer?" Center for a New American Security, August 13, 2020, <https://www.cnas.org/publications/commentary/export-controls-are-bigger-and-broader-but-are-we-safer>.

Technical Advisory Committee and the Committee on Foreign Investment in the United States (CFIUS).[30] Through a focus on emerging technology, the U.S. radically revised and conflated two otherwise disconnected control systems: export controls and FDI national security reviews.

Notwithstanding the new consensus on export control reform, the effort to identify otherwise nebulous categories of emerging and foundational technologies proved very limited in practice. Arguably, the limited technology identification results should not have been surprising given the earlier experience with the MCTL.[31] Nevertheless, BIS endeavored to categorize and list several emerging technologies. During 2019 and 2020, BIS authored four final rules related to emerging technologies, resulting in controls being placed on thirty-seven technologies. These included technologies such as post-quantum cryptographic algorithms and law enforcement surveillance software. From 2021-22, BIS extended its controls to include new emerging technologies, including software for nucleic acid assembly and geospatial imagery.[32]

The apparently slow pace of technology identification and therefore control was not sufficient for Congress. In 2021, the U.S.-China Economic and Security Review Commission published a report, "Unfinished Business: Export Control and Foreign Investment Reform," criticizing the slow pace and asserting that BIS was not fulfilling its responsibilities under ECRA.[33] Thereafter, Senator Tom Cotton (R-AR) along with nine other Republican senators wrote a letter to Secretary of Commerce Gina Raimondo urging her to direct BIS to expedite identifying emerging and foundational technologies as outlined in Section 1758.[34] The letter highlighted five technology areas crucial for America's strategic competition with China, including AI, quantum computing, semiconductors, biotechnology, and autonomous systems. The letter also emphasized the need for BIS to follow the Intelligence Community's example in identifying

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30 Interestingly, the MCTL was also intended to inform CFIUS decisions. However, according to DOD officials, the MCTL was not used to inform these decisions. Instead, the DOD relied on input from technical experts in the Directorate for Defense Research and Engineering on an ad hoc basis. See "Defense Trade: Enhancements to the Implementation of Exon-Florio Could Strengthen the Law's Effectiveness," Government Accountability Office, GAO-05-686, September 28, 2005, p. 22.

31 See Scott A. Jones, "Disrupting Export Controls: Emerging and Foundational Technologies and Next Generation Controls," *Strategic Trade Review*, Vol. 6, Issue 9 (Winter/Spring 2020). Jones notes: "Established in 1980, the MCTP was of limited practical utility. As revealed by GAO and other analyses, the MCTL and DSTL constructs were too broad and/or imprecise to be of direct use in controlling exports and investments and in conditioning control lists. These limitations notwithstanding, the extant military and dual-use control lists continued to operate seamlessly precisely because they are based on established weapons systems or platforms."

32 The 37 technologies were identified before ECRA but were cast as emerging technologies presumably to appease Congress. The Congressional pressure to identify emerging technologies was largely insensitive to the long-standing statutory tools available to BIS and the interagency. Namely, the routine list-making process and other regulatory routes such as the 0Y521 process. See Scott Jones and Kevin Wolf, "0Y521 and Section 1758: Emerging Technologies by any Other Name?" *World Export Control Review*, Issue 89, May 2016.

33 See "Unfinished Business: Export Control and Foreign Investment Reforms," U.S.-China Economic and Security Review Commission, June 1, 2021, <https://www.uscc.gov/research/unfinished-business-export-control-and-foreign-investment-reforms>.

34 "Letter from Senator Tom Cotton to Secretary of Commerce Gina Raimondo, United States Senate, November 15, 2021, <https://www.cotton.senate.gov/imo/media/doc/commerce_bis_letter.pdf>.

key American technologies that should be protected from the Chinese Communist Party, with a particular focus on technology acquisition by Chinese AI firms.

In response to pressure from Congress and the perceived lack of clarity and practicality in ECRA's inclusion of commodity categories without clear definitions, BIS published a proposed rule. This rule signified an important change in BIS's approach to identifying new technologies of high strategic importance for control. In a May 23, 2022 rule, BIS informed the public that the agency would no longer characterize new controls as corresponding to emerging or foundational technologies pursuant to Section 1758 of ECRA, instead referring to the technologies at issue as "Section 1758 technologies."[35]

In terms of policy modernizations, BIS has notably revised its export controls (e.g., the Military End-User List) and the scope of the Foreign Direct Product Rule (FDPR) in October 2022 and 2023, reflecting a strategic stance towards advanced computing and semiconductor manufacturing.[36] The 2022 rules initially targeted exports of advanced chips and semiconductor manufacturing equipment, focusing on preventing their use in China's military modernization, specifically in large-scale AI systems. A year later, the 2023 updates expanded these controls by revising the criteria for restricted chips and extending the geographic scope to include additional countries and entities headquartered in U.S. arms-embargoed nations. The October Rules are some of the most complicated export control policies to date.[37] Simultaneously, in 2022, BIS clarified and reorganized the FDPR, which has been in statutory form since 1959, consolidating the rules for greater coherence and addressing specific confusions around definitions and license requirements. Lastly, BIS is increasing its compliance messaging through policy updates (e.g., voluntary self-disclosure revisions and "multi-seal" notices) and enforcement (e.g., the 2023 USD $300 million enforcement action against Seagate for FDPR violations).[38]

FDI Controls: In and Out

Until recently, the Committee on Foreign Investment in the U.S. (CFIUS) operated in relative obscurity, with only an *ad hoc* headline presence. However, in light of China's expansive FDI efforts, deepening skepticism of Beijing's global intentions, and tighter growth margins in the global economy, CFIUS has been elevated in prominence as a hedge against emerging geoeconomic risks in general and against Chinese technology acquisition efforts in particular. During the 115th Congress (2017-2019), many Members expressed concerns over China's growing investment in the United States, particularly in the technology sector, the result of which was the Foreign Investment Risk Review Modernization Act (FIRRMA), which further

35 "Commerce Implements New Multilateral Controls on Advanced Semiconductor and Gas Turbine Engine Technologies," BIS Press Release, August 12,2022

36 See for example, Hanna Dohmen and Jacob Feldgoise, "A Bigger Yard, A Higher Fence: Understanding BIS's Expanded Controls on Advanced Computing Exports," Center for Security and Emerging Technology, December 4, 2023, <https://cset.georgetown.edu/article/bis-2023-update-explainer/>.

37 For example, the October 2023 rule is over 400 pages. See Reva Goujon and Jan-Peter Kleinhans, "All In: U.S. Places a Big Bet with October 17 Controls," Rhodium Group Research Note, November 6, 2023.

38 See Kyle Brasseur, "BIS Updates Voluntary Self-Disclosure Policy to Punish Not Coming Forward," *Compliance Week*, April 19, 2023 and Karen Freifeld, "Seagate to Pay USD $300 Million Penalty for Shipping Huawei 7 Million Hard Drives," *Reuters*, April 20, 2023.

empowered and broadened the CFIUS mandate.

In February 2020, CFIUS jurisdictional scope was broadened through regulatory amendments to include its authority to review non-controlling foreign investments in U.S. enterprises engaged in the development or production of critical technologies, execution of critical infrastructure functions, and the collection or storage of sensitive personal data of U.S. citizens, all under the purview of national security concerns. CFIUS has been proactively identifying and scrutinizing firms involved in such transactions that failed to seek CFIUS clearance before finalization. A notable instance in 2019 saw CFIUS compelling Beijing Kunlun Tech Co., Ltd. to divest its ownership of the dating app Grindr LLC, acquired in 2016, due to fears of potential misuse of sensitive U.S. personal data by the Chinese government. Additionally, CFIUS exerted pressure on Pamplona Capital Management, a fund with partial Russian investment, to relinquish its minority interest in a U.S. cybersecurity company.[39]

The U.S. government has been particularly focused on controlling technology mergers and acquisition in general, and by Chinese acquirers in particular.[40] Several recent high-profile cases focused on deals involving semiconductor design and manufacturing:

- In 2016, President Obama blocked the Chinese firm Fujian Grand Chip Investment Fund from acquiring Aixtron, a German-based semiconductor firm with U.S. assets.

- In 2017, President Trump blocked the acquisition of Lattice Semiconductor Corp. of Portland, Oregon for USD $1.3 billion by Canyon Bridge Capital Partners, a Chinese investment firm.

- In 2018, President Trump blocked the acquisition of semiconductor chip maker Qualcomm by Singapore-based Broadcom for USD $117 billion over China and 5G concerns.[41]

The technology acquisition loopholes closed by FIRRMA and accompanying technology denial logic has now been extended to U.S. outbound FDI into "countries of concern."[42]

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39 CFIUS's expanded authority under FIRRMA directs it to review investment transactions whether or not the investment conveys a controlling equity interest in certain cases. See "The Committee on Foreign Investment in the United States (CFIUS)," Congressional Research Service, RL33388, August 3, 2023, <https://crsreports.congress.gov/product/pdf/IF/IF10177>.

40 See for example, Blair Wang, "CFIUS Ramps up Oversight of China Deals in the US," *The Diplomat*, September 14, 2021. Greater scrutiny of Chinese acquisition and investment efforts by CFIUS has resulted in a significant drop in Chinese investments requiring a CFIUS review, from an average of 57 cases per year in the 2016-18 time period to 28 in 2019 and 22 in 2020.

41 Other rejected deals include Royal Philips's sale of a controlling interest in its Lumileds business to a Chinese buyer, Fairchild Semiconductor's rejection of a Chinese acquisition offer due to CFIUS risk, HNA Group's proposed acquisition of Global Eagle Entertainment Inc., and T.C.L. Industries Holdings' proposed purchase of Inseego Corporation. For more on CFIUS reforms, see "The Committee on Foreign Investment in the United States (CFIUS)," Congressional Research Service, RL33388, August 3, 2023, <https://crsreports.congress.gov/product/pdf/IF/IF10177>.

42 The order initially focuses on "countries of concern," currently only China (including Hong Kong and Macau), and investments in three sensitive technology sectors: semiconductors and microelectronics, quantum information technologies, and artificial intelligence.

In August 2023, President Biden enacted Executive Order (E.O.) 14105 which restricts *outbound* investment to China, Hong Kong, and Macau in areas deemed critical to U.S. national security. These include three main industries: advanced computing chips, microelectronics, and artificial intelligence (AI). In certain instances, particularly when the technology is intended for military or surveillance use, investment is completely forbidden. However, for products that are less sensitive, investment is allowed, provided that the government is notified.[43]

As outlined in a Department of Treasury ANPRM, the directive precisely focuses on investments that pose a risk of conveying "intangible benefits" like managerial know-how, access to talent networks, and pathways to market entry. It explicitly excludes passive investments in publicly traded instruments, such as stocks or bonds. The Treasury Department, tasked with enforcing these restrictions, indicated that they would be applicable solely to transactions conducted after the directive becomes operational in 2024. The proposed outbound investment scheme is set to include a series of specific bans and compulsory reporting requirements for investments in sectors like artificial intelligence, quantum computing, and semiconductor technology.[44] The ANPRM further formulates the government's increasingly unified technology denial strategy: "The PRC government explicitly seeks to advance these technologies and to ensure that new innovations simultaneously benefit its military and commercial aims. The PRC government is aggressively pursuing these objectives to confer a decisive advantage to its military, intelligence, surveillance, and cyber-enabled services."[45] In serial fashion, the U.S. government, including Congress, is progressively identifying gaps across its heretofore disjointed technology control regimes, from exports controls to FDI.

Ahead of the House-Senate conference on the 2024 National Defense Authorization Act, the Senate's resounding approval of the Outbound Investment Transparency Act signals a decisive move towards comprehensive investment controls. This bipartisan-backed act strengthens oversight over a wider range of sensitive technologies, including hypersonics, dual-use networked laser scanning systems, and satellite-based communications systems, addressing some minor gaps left by Executive Order 14105. This unified approach paves the way for a robust framework governing both inbound and outbound investments.[46]

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43 See Gregory Allen, "A New National Security Instrument: The Executive Order on Outbound Investment," Center for Strategic and International Studies, August 10, 2023, <https://www.csis.org/analysis/new-national-security-instrument-executive-order-outbound-investment>.

44 Noah Berman, "President Biden Has Banned Some U.S. Investment in China. Here's What to Know," Council on Foreign Relations, August 29, 2023. See also Ngor Luong Emily S. Weinstein, "A Guide to the Proposed Outbound Investment Regulations," Center for Security and Emerging Technology, October 6, 2023.

45 Advanced Notice of Proposed Rulemaking, <https://home.treasury.gov/system/files/206/Treasury-ANPRM.pdf>. See also Emily Benson and Gregory C. Allen, "A New National Security Instrument: The Executive Order on Outbound Investment," Center for Strategic and International Studies (CSIS), August 10, 2023.

46 As noted by Allen, op. cit, Representative Mike Gallagher (R-WI), chairman of the United States House Select Committee on the Chinese Communist Party, wrote a letter to the White House requesting a more expansive instrument. In the letter, Representative Gallagher argued that "[f]or too long, America has funded the CCP's military buildup, technological ambitions, and human rights abuses and allowed the CCP unconstrained access to our capital markets and the dynamism and efficient capital allocation that they enable."

Sanctions

Sanctions have a long and storied history as U.S. geoeconomic policy tools – the evolution of which has culminated in a broad continuum of general and very specific measures.[47] Beyond the now routine and byzantine sanctions against Iran and North Korea, recent sanctions actions have increasingly focused on Chinese and Russian individuals, officials, companies, and economic sectors.

China

The recent trends in U.S. sanctions against Chinese entities reflect a complex interplay between geopolitical competition, concerns over national security, human rights issues, and the strategic intent to curb China's technological advancements and economic influence. The relatively fewer sanctions imposed on Chinese targets, compared to those on Russia and Iran, can be attributed to the intricate and deeply intertwined economic relationship between the U.S. and China, alongside strategic considerations that reflect the complex nature of their bilateral ties.[48]

In September 2018, the United States leveled sanctions on China's Equipment Development Department (EDD), the military branch responsible for weapons and equipment, and its director, Li Shangfu, for engaging in "significant transactions" with Rosoboronexport, Russia's main arms exporter. The sanctions are related to China's purchase of 10 SU-35 combat aircraft in 2017 and S-400 surface-to-air missile system-related equipment in 2018, the State Department said.[49] While largely symbolic and based on legislation principally targeting Russia, the action revealed the consistent U.S. focus on denying military-related technology to China.

Related to sanctions actions (e.g., asset freezes and travel bans), the U.S. government, through the Department of Commerce, tightened sanctions on Huawei in May 2020. Huawei Technologies, along with 114 of its global affiliates, was already under a de facto export ban from the United States since May 2019, a measure that was reinforced by intensive diplomatic efforts aimed at severing the firm's access to Western markets. The enhanced restrictions prevent foreign companies from utilizing U.S.-origin designs or components to manufacture semiconductors essential for Huawei's product line. Shortly thereafter, the U.S. expanded its measures by placing an additional thirty-three Chinese entities on an export control blacklist citing their alleged involvement in human rights abuses or connections to the Chinese military.

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47 See for example, Richard Nephew, *The Art of Sanctions: A View from the Field* (New York: Columbia University Press: 2017).

48 U.S. calculus on sanctioning Chinese entities may be changing. Democratic Senator Gerald Connolly, member of the U.S. House Committee on Foreign Relations, said that lawmakers were already considering more sanctions after similar measures were proposed in the European Union. Senator Connolly noted: "China has to understand that the same kinds of sanctions which are beginning to really take hold in Russia and are affecting Russian productivity, economic performance and quality of life, can also be applied to China; and China has a lot more to lose." See Karen Gilchrist, "China Has a lot More to Lose: U.S. Considering Sanctioning Chinese Firms Aiding Russia's War," *CNBC*, February 19, 2024.

49 The sanctions action was based upon the Countering America's Adversaries Through Sanctions Act of 2017 (CAATSA), 115th Congress, August 2, 2017, <https://congress.gov/115/plaws/publ44/PLAW-115publ44.pdf>.

In parallel, U.S. lawmakers introduced legislation aimed at preventing a federal pension fund from investing in Chinese equities, curtailing Chinese firms' capacity to secure capital in the U.S. market, and imposing sanctions on Chinese officials implicated in suppression efforts.[50]

Russia

In the case of Russia, sanctions have intensified, especially following the invasion of Ukraine in 2022. U.S. sanctions have targeted Russia's defense, aerospace, and maritime sectors as well as individuals and government entities. These sanctions are designed to degrade Russia's ability to modernize its military capabilities and maintain its industrial base. The export controls implemented have been particularly effective in limiting Russia's access to high-tech items, including electronics and software, which are crucial for the development of advanced military systems.[51]

Both sets of sanctions against China and Russia have been coordinated with allies, ensuring a broader impact. The U.S. has worked closely with the European Union and other countries to align their sanction efforts, creating a more unified and effective approach to limiting technology access. This coordination is crucial because it reduces the ability of targeted countries to circumvent U.S. sanctions by turning to alternative sources for their technological needs.[52]

Assessment of Technology Controls

With China's economic and military rise, the U.S. has reassembled and combined the various aspects of economic policy, up to and including general trade policy (e.g., tariffs), to curtail China's Military-Civil Fusion (MCF) process. Export controls, FDI reviews, and sanctions are effective to the degree that they actually limit the ability of the target to acquire technology they are otherwise unable to procure or produce. While China's rapid economic development has

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50 During this period, the Department of Commerce also added SenseTime, Hikvison, and other Chinese companies to its Entity List, thereby prohibiting these entities from obtaining any hardware, software, or technology that is subject to the U.S. Export Administration Regulations. The Department of Defense (and other agencies) also prohibited federal agencies from buying "covered telecommunications equipment or services" from designated Chinese entities, including Huawei and ZTE, as a substantial or essential component of any system, or as critical technology as part of any system. In addition, the Administration has issued executive orders authorizing the Department of Commerce and the Department of Energy to issue regulations to review and mitigate certain types of transactions in the telecom and bulk energy sectors, respectively. See Andrew Rennemo, "With China Sanctions, America Pushes the Limits of Its Financial Power: U.S. Diplomacy has Developed an Unhealthy Dependence on Sanctions," *The Diplomat*, June 19, 2020; Kathy Gilsinan, "A Boom Time for U.S. Sanctions: The Explosive Growth in their Use has Prompted Questions About How Much is Too Much," *The Atlantic*, May 3, 2019; and "Economic Sanctions: Agencies Assess Impacts on Targets, and Studies Suggest Several Factors Contribute to Sanctions' Effectiveness," Government Accountability Office, GAO-20-145, October 2019, <https://www.gao.gov/assets/gao-20-145.pdf>.

51 Alena Epifanova, "Tech Sanctions Against Russia: Turning the West's Assumptions into Lessons," German Council on Foreign Relations, June 2023, <https://dgap.org/en/research/publications/tech-sanctions-against-russia>.

52 See for example, Scott Anderson, "What Sanctions Has the World Put on Russia?" Lawfare, 2March 24, 2022.

enabled significant growth in production sophistication and efficiency, China is still deficient in key strategic sectors, including jet engines and semiconductors, a point often noted in official publications.[53] For example, President Xi has variously cautioned that China is critically dependent on advanced economies regarding several chokepoint technologies and that "key core technologies are controlled by others," particularly military jet engines and advanced semiconductors.[54] These two technology sectors represent fundamental obstacles to both military modernization and further economic innovation objectives.

Jet Engines

China's military modernization has been noteworthy both for its speed and indigenized production of major weapons system platforms.[55] This being noted, the latter capacity has been limited to major land and marine systems. China's military aerospace capabilities are still highly dependent upon foreign technology, particularly jet engines. For example, in 2016, China's 13th Five-Year Plan for the National Development of Strategic Emerging Industries emphasized the importance of improving the performance of indigenous jet engine designs and the further development of the aerospace industry to move firmly to an indigenous production system.

The current fleet of People's Liberation Army Air Force (PLAAF) frontline and multi-role fighters bear the distinct marks of foreign lineages.[56] For example, as noted by Robert Farley, the J-10 is reportedly based on the Israeli IAI Lavi and, by extension, General Dynamics F-16; the J-11 is a copy of the Russian Su-27; the JF-17 is an updated development of the Soviet MiG-21; the J-20 bears a arresting resemblance to the F-22, and finally, "the J-31 is widely believed to rely heavily on technology appropriated from the F-35 Joint Strike Fighter."[57] Chinese efforts to reverse engineer certain Russian jet engines such as AL-31s and AL-117s

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53 See for example, Douglas Zhihua Zeng, "Measuring the Effectiveness of the Chinese Innovation System: A Global Value Chain Approach," *International Journal of Innovation Studies*, Volume 1, Issue 1 (2017), pp. 57-71 and Ben Murphy, "Chokepoints: China's Self-Identified Strategic Technology Import Dependencies," Center for Security and Emerging Technology, May 2022, <https://cset.georgetown.edu/publication/chokepoints/>.

54 See Xi, J. (2021), "Strive Hard to Become the World's Major Science Centre and Innovation Hub," Qiushi, March 15, 2021, <http://www.qstheory.cn/dukan/qs/2021- 03/15/c_1127209130.htm>, quoted in Yu Ji, "China's New Scientists: The Emerging Leaders Behind Beijing's Drive for Technological Self-Reliance," Chatham House, July 24, 2023, <https://www.chathamhouse.org/2023/07/chinas-new-scientists>.

55 See for example, "China Military Power: Modernizing a Force to Fight to Win," U.S. Defense Intelligence Agency, 2019 and Vance Hawkins, *China's Military Modernization and Search for Power* (London: Alpha Edition, 2018).

56 See Sebastien Roblin, "Most of China's Aircraft are Russian or American Copies," *The National Interest*, November 23, 2021. Regarding Chinese domestic jet engine production capabilities, Roblin notes: "Jet-engine tech remains the chief limitation of Chinese combat aircraft today. Indeed, in 2016 China purchased twenty-four Su-35s, the most sophisticated and maneuverable variant of the Flanker so far—likely to obtain their AL-41F turbofans engines."

57 See, Robert Farley, "Why China Struggles to Produce an Indigenous Jet Engine," *The National Interest*, September 21, 2022 and Dimitri Simes, "Russia Up in Arms over Chinese Theft of Military Technology: Beijing's Rise as a Major Armaments Exporter is a Double-Edged Sword for Moscow," Nikkei Asia Times, December 20, 2019.

during the 1990s and 2000s invariably produced engines with extremely short lifespans and without the power of their Russian counterparts.[58]

A recent study of China's military aerospace modernization concludes the following regarding jet engine production capacity:

> *"China's struggle to indigenously develop aircraft engines thus throws into question the growing belief among observers that China has closed the military-technological gap with the United States with respect to fifth generation fighters.[59] Possibly more important, it also illustrates that the advantages of imitation that China has enjoyed have inevitably been limited. As mentioned earlier, several factors significantly facilitated China's efforts to develop turbofan engines; and from 2010 to 2015, it spent some USD $22 billion to develop an indigenous engine for its combat aircraft. Yet, as of 2019, it continues to struggle."*[60,61]

Reliance on Russian jet technology and the limited ability to reverse engineer hot section components has sharply limited Beijing's ability to indigenously produce its own military-grade turbofan engines.[62] Despite warming relations with China, Moscow is unlikely to share the associated intellectual property (IP) precisely because of IP theft concerns.[63] Furthermore, the U.S. can deploy sanctions against Russia for deepening military-technical cooperation, as was the recent case involving S-400 and Su-35 sales which resulted in Russian and Chinese sanctions. Lastly, the U.S. will continue to use unilateral and plurilateral (e.g., coordination with other jet engine technology providers such as France) export controls against the Chinese

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58 Dimitri Simes, "Russia Up in Arms over Chinese Theft of Military Technology: Beijing's Rise as a Major Armaments Exporter is a Double-Edged Sword for Moscow," *Nikkei Asia Times*, December 20, 2019.

59 The J-20 does not possess supercruise (e.g., increased engine thrust that enables sustained supersonic flight without the need for inefficient afterburners) capabilities, so it is not a 5th generation fighter. See also John A. Tirpak, "Pentagon: China Working on Upgrades to Top Stealth Fighter, Manned-Unmanned Teaming," *Air and Space Forces Magazine*, October 24, 2023, <https://www.airandspaceforces.com/pentagon-china-upgrades-top-stealth-fighter/>.

60 Author's note: Minnie Chan, "China Powers Up Military Jet Engine Tech to Wean Itself Off Russian Imports," *South China Morning Post*, December 12, 2016. The amount is 168 billion yuan, approximately equivalent to USD $21–$24 billion.

61 Andrea Gilli and Mauro Gilli, "Why China Has Not Caught Up Yet Military-Technological Superiority and the Limits of Imitation, Reverse Engineering, and Cyber Espionage," *International Security*, Vol. 43, No. 3 (Winter 2018/19), pp. 141–189.

62 It should also be noted that China has relied on Ukrainian engine imports and designs as detailed by the U.S. Department of Defense: "China has a longstanding reliance on Russian- and Ukrainian-built engines for fixed and rotary wing aircraft produced domestically…. Russia's war on Ukraine probably will impede China's ability to acquire military equipment and maintenance services from either country." See "Annual Report to Congress: Military and Security Developments Involving the People's Republic of China," Office of the Secretary of Defense, 2023.

63 Regarding Chinese reverse engineering, a recent review of Russian military jet transfers to China notes: "To be sure, China still imports turbofan engines from Russia as it struggles to perfect domestic alternatives such as the WS-10B and eventually the powerful WS-15. However, the latest Chinese fighters increasingly incorporate weapons and avionics that are more capable than those of their Russian counterparts." Sebastien Roblin, "Why China's Latest Jets Are Surpassing Russia's Top Fighters," *Forbes*, November 10, 2020.

military's jet engine indigenization efforts. In 2020, for example, U.S. Department of Commerce published a Military End-User (MEU) List requiring export licenses for exports, re-exports, and in-country transfers of aerospace equipment and technology.[64]

Despite apparent and episodic advances in engine design and production capabilities, the related literature strongly suggests that China is incapable of producing peer-equivalent high-performance/-reliability military jet engines. Therefore, domestic production limitations are an abiding handicap in Beijing's military modernization plans.[65] As such, Washington will continue to target associated technologies through export controls, sanctions, and FDI controls.[66]

Semiconductors

China famously imports more semiconductors than oil to power its economy. For example, in 2022, China imported USD $415.58 billion worth of semiconductors compared with USD $365.51 billion in crude oil, with most semiconductors being of direct or indirect U.S. origin.[67] More so than jet engines, mastery of semiconductor manufacturing is critically central to the projected high technology base of both future economic and military power for China.

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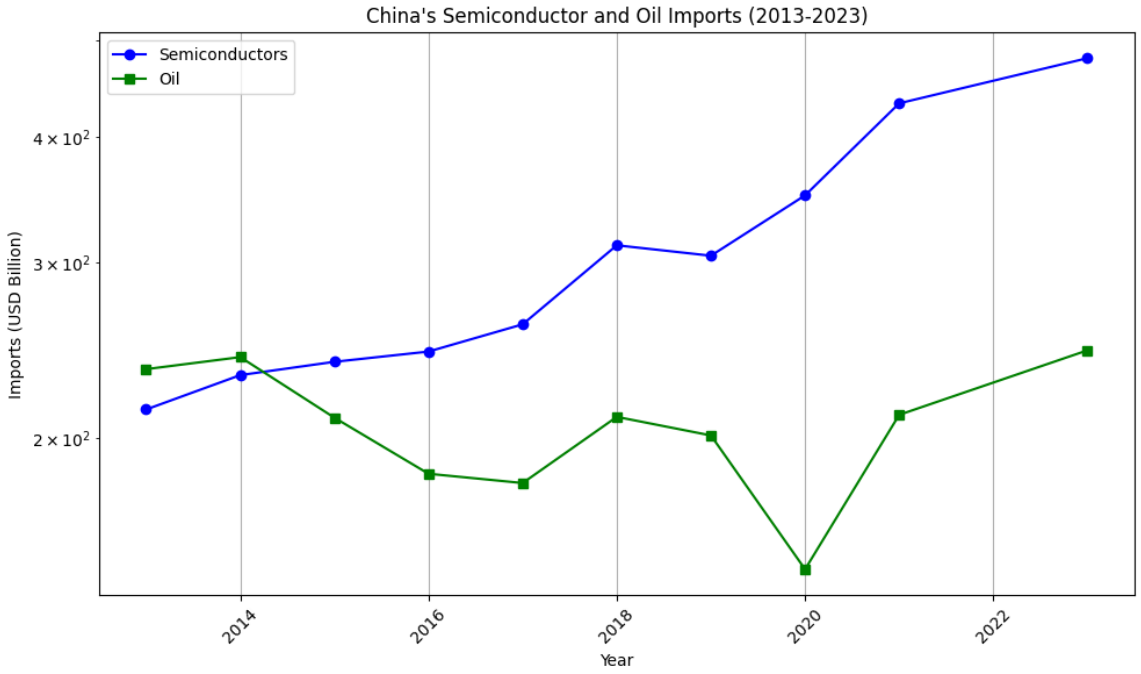
64 U.S. export controls may also impact civilian aerospace development efforts. Authorities are attempting to replace the Leap engines – manufactured a under a U.S.-French consortium – currently powering the C919, China's first domestically developed narrow-body passenger jet. According to Liu Daxiang, deputy director of the science and technology committee at the Aviation Industry Corporation of China (Avic), China lacked experience in the research and development of an engine for commercial aviation. Mechanical failures are among the most common problems seen in Chinese made jet engines, according to research released in 2022 by the Hunan civil-military integration of public service platform, an information provider under the Military-Civilian Integration Development Committee of the Hunan provincial government. Poor design, a low level of manufacturing, and a lack of experience in testing and assembly are also common problems, the research said. See Amanda Lee, "How Monumental is China's Challenge to Build its Own Jet Engine for the C919 as it Seeks Aviation Self-Reliance?" *South China Morning Post*, February 11, 2024.

65 See Alexander Holderness, et al., "Powering Proliferation: The Global Engine Market and China's Indigenization," Center for Strategic and International Studies (CSIS), March 21, 2023 and Robert Farley, "Why China Struggles to Produce an Indigenous Jet Engine," *The National Interest*, September 21, 2022. See also, Richard Aboulifa, "If China Arms Russia, the U.S. Should Kill China's Aircraft Industry," *Foreign Policy*, March 20, 2023.

66 Liu Daxiang, the Deputy Director of the Science and Technology Committee at the state-owned Aviation Industry Corporation of China, called the development of domestic jet engines "a serious and urgent political task" and said China was facing an "[u]nprecedented challenge…The established countries in aviation have become more strict with us when it comes to technology access," Liu said, adding that recent U.S. efforts to restrict opportunities for the Chinese telecommunications firm Huawei "tells us that crucial technology cannot be bought, even if you spend big." See Amanda Lee, "China Faces Urgent 'Unprecedented Challenge' to Develop Jet Engine as Foreign Hostility Grows," *South China Morning Post*, December 17, 2020.

67 U.S. semiconductor companies—including both integrated device manufacturers (IDMs), which design and manufacture their products in their own facilities, and fabless design companies, which rely on independent foundries to fabricate their chips—supplied approximately 48% of the global market for semiconductors in 2018. See Yoku Kobuta, "China Sets Up New $29 Billion Semiconductor Fund Government-Backed Fund is Part of Continuing Effort by China to Become Less Dependent on U.S. Technology," *The Wall Street Journal*, October 15, 2019. See also Owen Daniels and Will Hunt, "Sustaining and Growing the U.S. Semiconductor Advantage: A Primer," Center for Security and Emerging Technology, June 2022.

Table 1. China's semiconductor and oil imports (2013-2023).



Although the U.S. Department of Defense (DoD) currently accounts for approximately 1% of the semiconductors industry's revenue, electronics components are ubiquitous in defense and weapons systems and therefore remain critical to U.S. military capabilities.[68] The defense modernization priorities laid out in the 2018 U.S. National Defense Strategy include microelectronics, 5G, and quantum science as strategic areas requiring U.S. investment. Other priority areas – such as cybersecurity, AI, autonomous systems, and advanced imaging equipment – rely heavily on advanced semiconductor capabilities as well. In what analysts are increasingly referring to as a "tech war" between China and the U.S., the centrality of semiconductors is apparent in the narrowing focus of U.S. economic statecraft against China.[69]

The Made in China 2025 plan calls for Chinese semiconductor companies to produce 80% of chips domestically, but this goal is far from being realized.[70] Chinese semiconductor companies accounted for only USD $4.7 billion out of USD $23.8 billion worth of local

68 See Antonio Varas and Raj Varadarajan, "How Restricting Trade with China Could End U.S. Semiconductor Leadership," The Boston Consulting Group, March 9, 2020

69 See for example, Brad Slingerlend, "A Semiconductor 'Cold War' is Heating Up Between the U.S. and China," *Market Watch*, June 2, 2020; Steve Blank, "The Chip Wars of the 21st Century," *War on the Rocks*, June 11, 2020, <https://warontherocks.com/2020/06/the-chip-wars-of-the-21st-century/>.; and "Chip Wars: China, America and Silicon Supremacy," *The Economist*, December 1, 2018.

70 For example, China's Semiconductor Manufacturing International Corporation's (SMIC) 14 nm fabs represent only 2.6% of global chip fab capacity for near-state-of-the-art chips; adjusted for quality, this number further shrinks to 1.1%. And much of SMIC's 14 nm capacity is aspirational, true capacity is likely even lower. See Saif M. Khan and Carrick Flynn, "Maintaining China's Dependence on Democracies for Advanced Computer Chips," The Brookings Institution, April 2020 and Alex Capri, "Semiconductors at the Heart of the US-China Tech War How a New Era of Techno-Nationalism is Shaking up Semiconductor Value Chains," Hinrich Foundation, January 2020.

production in 2018 and Chinese producers are nowhere near manufacturing state-of-the-art level chips (<7 nanometers).[71] In June 2014, the Chinese government published "Guidelines to Promote National Integrated Circuit Industry" (the China National IC Plan, also known as the "China Big Fund"). The China National IC Plan called for USD $150 billion in funding both from the central government as well as provincial and municipal governments to increase domestic capacity and sophistication. Nevertheless, China remains years behind the leading semiconductor producers.[72]

The late 2023 announcement by Huawei about the production of a 7-nanometer (nm) chip has sparked discussions about China's capabilities in the semiconductor industry and, therefore, the effectiveness of U.S. controls. The 7nm chip was found in Huawei's new smartphone, the Mate 60 Pro, and was produced by China's leading domestic chipmaker, Semiconductor Manufacturing International Corporation (SMIC), both of which are on the BIS Entity List. According to TechInsights, a Canadian technology research firm, the chip showed various identifying features that point to fabrication by SMIC. SMIC has been able to produce the 7 nm chip for well over a year using a technique called "multi-patterning," but only in limited quantities.[73]

Despite this recent development, there are doubts about the sustainability of 7nm production with China's current capabilities.[74] Due to export controls led by the United States, the lack of access to advanced extreme ultraviolet lithography (EUV) machines is a critical limitation. These controls, which include restrictions on the export of logic chips and related

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71 For example, China's Semiconductor Manufacturing International Corporation's (SMIC) 14 nm fabs represent only 2.6% of global chip fab capacity for near-state-of-the-art chips; adjusted for quality, this number further shrinks to 1.1%. And much of SMIC's 14 nm capacity is aspirational, true capacity is likely even lower. See Saif M. Khan and Carrick Flynn, "Maintaining China's Dependence on Democracies for Advanced Computer Chips," The Brookings Institution, April 2020.

72 See Daniel Sims, "U.S. Sanctions Will Keep China 10 years Behind on Chipmaking, Intel CEO Says: U.S. Restrictions on Chipmaking Tools a Critical Factor," Tech Spot, January 28, 2024 and James Lewis, "China's Pursuit of Semiconductor Independence," Center for Strategic and International Studies (CSIS), February 27, 2019 and Edward White, "China's Ability to Make Computer Chips Still 'Years Behind' Industry Leaders: Rising Costs of R&D and Manufacturing Create New Hurdles," *Financial Times*, January 21, 2019. See also Rhett Hatch," Why China's Semiconductor Industry Remains Behind," *The National Interest*, January 31, 2022.

73 Apparently, the chip is the first commercial use of the most advanced logic process node without extreme ultraviolet (EUV), manufactured by a Chinese foundry that supports full system-on-chip (SoC) functional elements like bit cells (embedded SRAM). See William Reinsch and Matthew Schleich, "Contextualizing the National Security Concerns over China's Domestically Produced High-End Chip," Center for Strategic and International Studies (CSIS), September 26, 2023 and "Analysis of the Huawei Mate 60 Pro Reveals SMIC 7nm (N+2)," TechInsights, October 8, 2023.

74 William Reinsch and *op.cit*, "Contextualizing the National Security Concerns over China's Domestically Produced High-End Chip," Center for Strategic and International Studies (CSIS), September 26, 2023. The authors note, in particular, that "[w]hile it is, on the surface, concerning for U.S. lawmakers to see SMIC produce a 7 nm chip for Huawei, a deeper analysis suggests that U.S.-led export controls are limiting China's domestic semiconductor production capabilities. SMIC's reliance on imported DUV lithography machines—in the absence of well-controlled EUV machines—is likely to make 7 nm chip production unprofitable and unsustainable in the long term. Additionally, preventing the import of ASML's EUV machines by Chinese firms puts a hard stop on attempts to go smaller than 7 nm."

manufacturing equipment, have been instrumental in limiting China's ability to produce advanced semiconductors domestically.[75] Commerce Secretary Gina Raimondo confirmed these suspicions, saying that there was "no evidence" that China could produce these 7 nm chips at scale.[76]

As noted earlier, the current focus for U.S. export controls, sanctions, and FDI reviews is on "emerging technologies," almost all of which depend on advanced semiconductors. Washington's global pursuit of Chinese tech giant Huawei, for example, has involved all aspects of current U.S. technology-focused economic statecraft.[77] In recent months, the U.S. government has revised export control regulations to limit Huawei's access to semiconductors through direct product acquisition and through production of semiconductors using U.S.-origin technology or equipment, the latter by a revised provision of the Foreign Direct Product Rule.[78] Washington has also recently pressured the Dutch government to discourage permitting the export of extreme ultraviolet lithography (EUV) equipment to China. The Dutch company, ASML, is the sole manufacturer of EUV equipment required to make the most advanced semiconductors.[79] Washington has likewise rejected a number of Chinese attempted acquisitions of semiconductor-related companies such as Lattice Semiconductor Corporation, Fairchild Semiconductor, and Xcerra Corporation.[80]

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75 With respect to lithographic machines, Zhang Weiwei notes: "However, unlike Nvidia, which holds absolute authority in chip design and can circumvent regulatory measures with "special AI chips," ASML's photolithography machines consist of up to 100,000 parts from over 5,000 global suppliers. The most critical component, especially the EUV light source, is almost entirely monopolized by the American company Cymer. Even for the DUV light source, while some Japanese and Chinese companies relentlessly pursue it, there is still a gap compared to ASML's standards. This is the root of America's confidence in its "long-arm jurisdiction."" Zhang Weiwei, "2024: How Does China Overcome the U.S.' Chip Sanctions?" *The China Academy*, January 31, 2024.

76 Nicolle Prickett, "So What if China has 7nm Chips Now, There's No Way Huawei it Can Make Them "At Scale": Or So says U.S. Commerce Secretary," *The Register*, September 19, 2023.

77 Notably, Huawei has not been added to the Treasury Department's Specially Designated Nationals (SDN) list, which would directly deny Huawei access to the U.S. financial market and related services and indirectly chill cooperation with foreign financial institutions and technology providers. However, Congress has recently explored this option. For example, in 2023 Representatives Mike Gallagher (R-WI) and alongside Ruben Gallego (D-AZ) introduced the Neutralizing Emerging Threats from Wireless OEMs Receiving direction from Kleptocracies and Surveillance states (NETWORKS) Act, legislation that would add foreign companies producing 5G technology, like Huawei, to the SDN should they engage in economic or industrial espionage or sanctions violations.

78 Kevin Wolf, et al., "U.S. Government Clarifies, Reorganizes and Renames Descriptions of How Foreign-Produced Items Outside the United States Are Subject to U.S. Export Controls as the U.S. Contemplates New Restrictions on Russia," Akin, February 9, 2022.

79 Alexander Alper, "Trump Administration Pressed Dutch Hard to Cancel China Chip-Equipment Sale," *Reuters*, January 6, 2020. See also Martijn Rasser, "Countering China's Technonationalism: A New Approach is Needed if Today's Leaders are to Maintain their Primacy in Cutting-Edge Technology," *The Diplomat*, April 24, 2020.

80 See "Greg Roumeliotis, "U.S. Blocks Chip Equipment Maker Xcerra's Sale to Chinese State Fund," *Reuters*, February 22, 2018.

Conclusion: This is Not Your Grandparent's Cold War

On April 28, 2020, the Department of Commerce's Bureau of Industry and Security (BIS) published an amendment the Export Administration Regulations (EAR) that tightens restrictions on exports of technology to China, Russia, and Venezuela.[81] According to then Commerce Secretary Wilbur Ross, these actions were intended to combat efforts by entities in China, Russia, and Venezuela to use certain U.S. technologies obtained through civilian supply chains or under civilian-use pretenses to develop weapons, military aircraft, and surveillance technology contrary to U.S. national security interests. Including Chinese military end-users was a key component of the amendment as a military end-user is now defined as "any person or entity whose actions or functions are intended to support military end-uses," and this definition is aimed directly at China's Military-Civil Fusion program.

During the canonical Cold War, export controls had long been a part of the U.S. effort to limit Soviet military modernization. The same tools are likewise now arrayed against Russian and Chinese military development. As strategic tools they are necessary but not sufficient given the complexities attendant to globalization and the integration of supply chains and production networks.[82] As the global strategic environment has evolved to include the cyber and virtual domains, technological superiority is the new metric in establishing military dominance. Sensing that shift, the U.S. is now integrating heretofore disconnected economic policy tools to protect its technological advantages. Through export controls, sanctions, and FDI national security reviews, Washington is pursuing a whole-of-government technology access denial program. A key focus of this approach is on chokepoint technologies, such as jet engines and, more significantly, semiconductors.

On balance, these tools are effective in the short to medium term as China, and others, will eventually catch up in the relevant technology sectors.[83] Washington will continue to use and expand these tools during this period of efficacy. However, it is unclear if the U.S. has, in parallel, developed a strategy for confronting an adversary that no longer relies on U.S. technology or how to simultaneously leverage domestic economic policies (e.g., subsidies) to

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81 "Expansion of Export, Reexport, and Transfer (in-Country) Controls for Military End Use or Military End Users in the People's Republic of China, Russia, or Venezuela," *Federal Register*, April 28, 2020, <https://www.govinfo.gov/content/pkg/FR-2020-04-28/pdf/2020-07241.pdf>.

82 See Ling S. Chen, Miles M. Evers, "Wars Without Gun Smoke": Global Supply Chains, Power Transitions, and Economic Statecraft," *International Security*, Vol. 48, No. 2 (Fall 2023), pp. 164–204 and Kevin Ward, et.al., "The Second Cold War: US-China Competition for Centrality in Infrastructure, Digital, Production, and Finance Networks," *Geopolitics*, September 7, 2023.

83 See for example, Frank Tang, "U.S. Technology Embargo List Gives China a Blueprint for Home-Grown Innovation Over the Next Decade, Top Science Official Says," *South China Morning Post*, September 17, 2020.

achieve similar objectives.[84]

84 In a recent Foreign Affairs piece, Henry Farrell and Abraham Newman comment on the U.S. effort to use these otherwise disconnected economic and foreign policy tools to limit the strategic ambitions of adversaries. In particular, they note: "Responding to the coming challenges, however, will involve more than reorganizing bureaucracies. The United States needs to build a comprehensive economic security strategy. U.S. officials have said little about how they plan to do so... To get economic security right, the U.S. government must reinvent itself." See, "The New Economic Security State: How De-risking Will Remake Geopolitics," *Foreign Affairs*, November/December 2023.

The Critical Role of Customs and Trade Controls in Mitigating Climate Change

BENJAMIN E. ZALISKO[1]

Abstract

Climate change is a global threat caused primarily by the burning of fossil fuels and similar in scale and character to threats posed by Weapons of Mass Destruction (WMD). Mechanisms and institutions restricting international trade in weapons and dual-use materials are long established and can be applied to restrict and redirect supplies of fossil fuels. Customs authorities are increasingly enforcing carbon pricing schemes via carbon border adjustments, requiring new expertise among strategic trade management stakeholders in assessing the relative climate risk of exports and the assessment of imports' carbon intensity using carbon lifecycle analysis. The structure and implementation of such policies can drive virtuous trade imbalances that incentivize broader adoption of climate mitigation policies and mollify political constituencies. Speed is paramount in this climate crisis, and many unilateral changes can be made, now. Eventually, multilateral institutions and treaties are needed to align complex and disparate carbon pricing and strategic trade controls on fossil fuels to reduce administrative burdens, carbon leakage, and reshuffling to avoid trade restrictions on fossil fuels. Capacity-building programs in strategic trade management are needed to assist in the technical implementation of such policies. In all such climate policies, nonproliferation history is a guide.

Keywords

Climate change, fossil fuels, nonproliferation, export controls, carbon tax, emissions trading, carbon border adjustment, World Trade Organization

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Climate Science and Policy Jargon

- **Climate Change:** Observed and projected changes in Earth's climate, including interrelated shifts in temperature, precipitation, and weather patterns.
- **Global Warming:** The aspect of climate change that describes increases in Earth's average temperature, primarily caused by the burning of fossil fuels.
- **Fossil Fuels:** Hydrocarbons (molecules made of mostly hydrogen and carbon atoms) in the form of coal, oil, and natural gas, which are extracted from the Earth and burned to produce energy like electricity or refined into fuels for vehicles like cars and aircraft.
- **Drop-In Fuels:** Alternative fuels that can be used instead of fossil fuels without replacing existing fossil fuel infrastructure, such as ethanol mixtures in gasoline-powered vehicles.
- **Greenhouse Gas (GHG) Emissions:** Gasses like carbon dioxide (CO_2), methane, and nitrogen oxides (NO_X), which increase the atmosphere's absorption of solar radiation, increasing average global temperatures.
- **Global Warming Potential (GWP):** The potency of a greenhouse gas in raising average global temperatures.
- **CO2 Equivalent (CO_2e):** A common unit to describe the global warming potential of a mixture of greenhouse gasses, standardized in comparison to carbon dioxide (CO_2).
- **Social Cost of Carbon (SCC):** The economic cost of GHG emissions, usually expressed in U.S. Dollars per ton of CO_2e.
- **Mortality Cost of Carbon (MCC):** The cost of GHG emissions in excess human deaths per ton of CO_2e.
- **Carbon Capture:** Technology that attempts to capture and sequester GHG emissions, theoretically enabling the burning of fossil fuels and limiting the negative impacts of atmospheric GHG emissions.
- **Carbon Pricing Scheme (CPS):** An umbrella term for demand-side government policies that raise prices on fossil fuels, derivative products, or other sources of GHG emissions.
- **Carbon Intensity:** The total GHG emissions associated with any good or service.
- **Carbon Lifecycle Analysis (LCA):** A type of analysis that attempts to quantify the carbon intensity of any good or service throughout its lifecycle, considering all inputs and outputs of production, use, and waste.
- **Carbon Border Adjustment (CBA):** A tariff calculated on the basis of the carbon intensity of an imported product or service. Coupled to a carbon pricing scheme, it taxes imports based on how they would have been priced had they been produced domestically and subject to the importer's domestic carbon pricing scheme.
- **Carbon Leakage:** GHG emissions that a carbon pricing scheme was intended to reduce but which evaded carbon pricing or other restriction.
- **Reshuffling:** Avoiding carbon pricing or trade restrictions by shifting emissions or relatively high carbon intensity products outside the scope of a CPS or to trading partners with more permissive CBA policies, resulting in carbon leakage.

Introduction

Climate change is an urgent and acute global threat that requires global solutions. Meeting the Paris Agreement's 1.5 ºC commitment and averting the worst impacts of climate change requires a rapid transition away from fossil fuels and restrictions so severe that even fossil fuel sources that have already been developed are left unburned.[2,3] Tens of millions of deaths and tens of trillions of dollars in damage hang in the balance.[4]

With imports and exports constituting over half of global Gross Domestic Product (GDP), mitigating the climate threat will rely on the community of stakeholders in trade controls and customs enforcement to manage the cross-border proliferation of fossil fuels.[5] However, confronting this challenge will require climate expertise and investments in enforcement infrastructure that strategic trade management communities may lack when traditionally focused on state competition, malicious actors, emerging technologies, and historic proliferation threats (nuclear, radiological, chemical, biological, and conventional weapons).

To support such investments in fossil fuel nonproliferation infrastructure, this article introduces the climate threat and policy landscape to a potentially unfamiliar audience of trade management professionals, customs authorities, and security experts. It focuses on the concepts, trade-offs, and practical implications of existing and emerging climate policies from the perspective of these implementers, informing their strategic planning and investments in expertise, analysis, enforcement infrastructure, and foreign assistance. These practicalities of implementation are also important considerations for economists, trade negotiators, and policy-makers when designing such policies. This article focuses on climate mitigation policies and practices. It does not address climate adaptation, the changes and investments required to build resilience to climate change, or climate impacts on traditional, weapons proliferation threats. These are distinct and important considerations for this community of stakeholders but are outside the scope of this article.

This article will not detail tactical, political mechanisms by which such policies should be advanced, but it will introduce a number of strategic political advantages that such an approach has over alternate conceptions of climate mitigation. Optimism can be found in parallels with the history of international security and nonproliferation solutions and the field's solutions to collective action problems, which are similar to climate change. The primary goal of this article is to demonstrate the depth and breadth of fossil fuel nonproliferation as a climate solution and

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2 H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama, et al., "Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change," IPCC, 2022, Cambridge University Press, <https://www.ipcc.ch/report/ar6/wg2/>.

3 Dan Welsby, James Price, Steve Pye, Paul Ekins, "Unextractable Fossil Fuels in a 1.5 °C World," *Nature*, Vol. 597 (2021), pp. 230–234, <https://www.nature.com/articles/s41586-021-03821-8>.

4 Based on calculations of the Social Cost of Carbon and Mortality Cost of Carbon, discussed in Section 1.4.

5 Trade (% of GDP) reported by The World Bank. See World Development Indicators DataBank, World Bank, <https://databank.worldbank.org/source/world-development-indicators/Series/NE.TRD.GNFS.ZS>.

its strategic advantages for proponents of climate mitigation policies.

Part 1 of this article provides an overview of climate change and fossil fuels. Part 2 discusses the scale and nature of climate impacts, drawing parallels between fossil fuels and traditional proliferation threats like WMD and dual-use materials. Both risks can be mitigated by controlling the proliferation of specific materials through export/import licensing regimes and customs enforcement. Mitigating both types of threats relies on trade controls, international norms, and multilateral cooperation.

Parts 3 and 4 present complimentary categories of climate mitigation policies enforced at international borders, both of which draw on necessary climate expertise and analytical capabilities in customs and trade enforcement. Part 3 proposes supply-side trade controls like export and import controls on fossil fuels. It includes a framework for evaluating the relative climate impact of exports, analogous to risk assessments that inform licensing decisions on dual-use exports. The goal of these policies would be to allocate fossil fuels to end-users with the least relative climate impact and the greatest humanitarian need.

In Part 4, demand-side carbon pricing schemes are introduced, scores of which are already established around the world. Domestic, economic carbon pricing schemes (CPS) work in concert with carbon border adjustments (CBA) to impose higher prices on fossil fuels and derivative products. With a CBA, customs authorities assess tariffs on imports and CPS rebates on exports on the basis of a product's carbon intensity, coupled to how the product is, or would have been, priced according the country's domestic CPS. This World Trade Organization (WTO)-authorized mechanism ensures the effectiveness of carbon pricing schemes by reducing carbon leakage and countering freeloaders. Well-constructed carbon border adjustments also reward countries with higher prices on carbon without the risk of retaliatory tariffs, creating a competitive dynamic that incentivizes impactful carbon pricing schemes around the world. This first-mover advantage and virtuous imbalance is one of the most important political advantages of such a policy. The European Union (EU) will implement the first sweeping and impactful carbon border adjustment in 2026, shifting the dynamics of international trade in that direction. Every country that trades with the EU would benefit economically from preparing their own carbon pricing scheme in response.

Part 5 discusses implementation challenges of both types of policies, some of which can be leveraged to amplify climate progress. The existing multilateralism and capacity building of nonproliferation trade controls will play an important role.

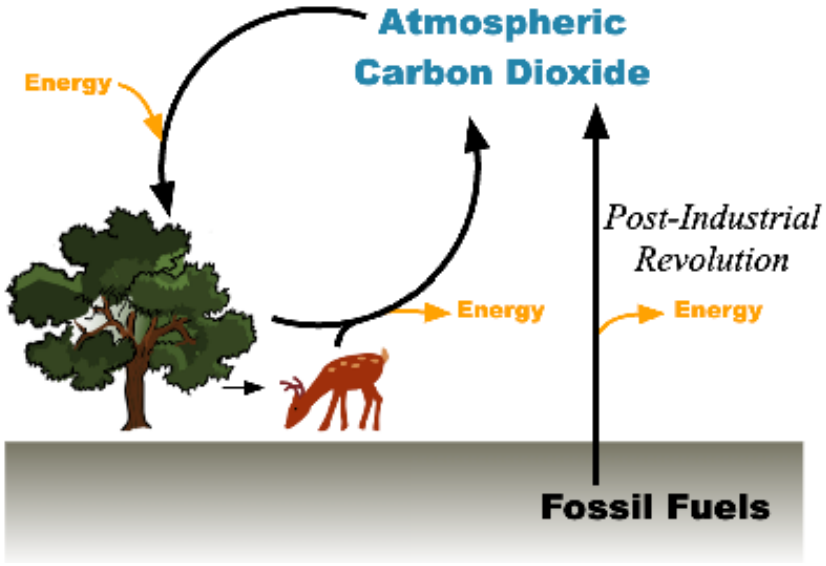
Part 6 concludes the article, summarizing the recommendations and their interplay while outlining a potential political roadmap.

Part 1: Climate Change Overview

1.1 How Fossil Fuels Unbalance the Carbon Cycle

The carbon cycle (Figure 1) is a fundamental process of life on Earth.[6] Plants and microorganisms turn atmospheric carbon dioxide (CO_2) into organic tissues that store chemical energy, like using solar energy to charge a chemical battery. That carbon is returned to the atmosphere in the form of respiration by plants and animals or by oxidation, the burning or slow decomposition of those tissues.

Figure 1. The carbon cycle



Fossil fuels (coal, oil, and natural gas) were once organic tissues that were sequestered from that carbon cycle before their chemical energy was released. Pressure and time drove off most of the oxygen from those tissues, increasing the energy density of the resulting hydrocarbons. Most fossil fuels have been sequestered from the global carbon cycle for about 300 million years, buried during a particular boom in plant life during the Carboniferous period, a time long before mammals, let alone humans, ever lived.[7,8] Human civilization has only flourished over the past few thousand years during a time of especially stable and temperate climate. However, the burning of fossil fuels and the destruction of old growth forest has upset the modern balance of the carbon cycle. Deforestation further reduces the capacity of plants to remove CO_2 from the atmosphere.

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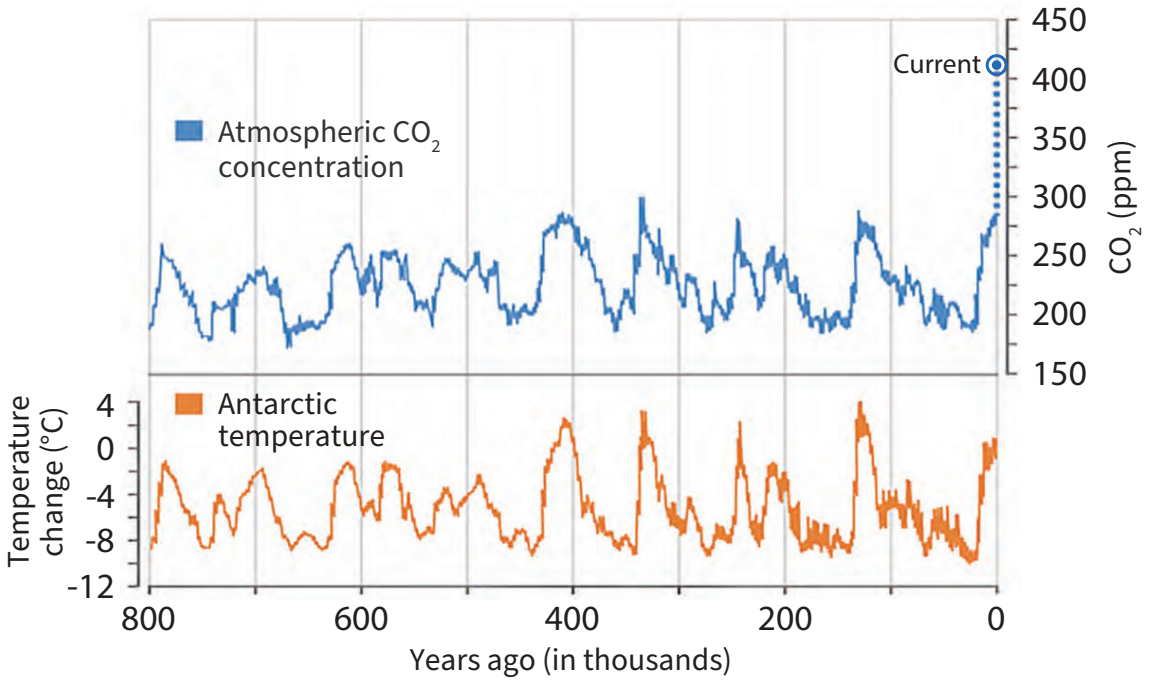
6 Robert A. Berner, "The Long-Term Carbon Cycle, Fossil Fuels, and Atmospheric Composition," *Nature*, Vol. 426 (2003), pp. 323–326, <https://doi.org/10.1038/nature02131>.

7 Ibid.

8 Matthew P. Nelsen, William A. DiMichele, Shanan E. Peters, C. Kevin Boyce, "Delayed Fungal Evolution Did Not Cause the Paleozoic Peak in Coal Production," Vol. 113 (2016), pp. 2442-2447, <https://www.pnas.org/doi/10.1073/pnas.1517943113>.

CO_2 is a greenhouse gas (GHG) in that the more CO_2 is in the atmosphere, the greater the fraction of solar energy is absorbed, raising global average temperatures (Figure 2).[9] CO_2 is not the only GHG, nor is it the strongest, but it is the most significant atmospheric product of human and other biological activity.

Figure 2. Antarctic ice cores show 800,000 years of CO2 increases followed by temperature increases.[10]



Complex mixtures of greenhouse gasses are often expressed in tons of CO_2 equivalents (CO_2e).[11] This calculation is based on the relative global warming potential (GWP) of each GHG. For example, methane traps 29.8 times more sunlight by mass than CO_2, so 1 kg of emitted methane is the equivalent of 50 kg of emitted CO_2 in terms of GWP. Nitrous oxide has 298 times more GWP than CO_2 by mass. Sulfur dioxide actually reflects sunlight, so it has negative GWP. An important caveat of GWP is atmospheric lifetime. For example, methane only lasts in the Earth's atmosphere for about 12 years, while CO_2 lasts for centuries. So, GWP calculations relative to CO_2 can vary somewhat based on whether short-term or long-term impact is prioritized.

There are other second-order affects that exacerbate global warming. Higher temperature

9 "Overview of Greenhouse Gases," U.S. Environmental Protection Agency, Updated August 25, 2023, <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>.

10 Figure 2 is republished from The Royal Society, "Climate Is Always Changing. Why Is Climate Changing Now?" Jeremy Shakun, data from Lüthi et al., 2008 and Jouzel et al., 2007, <https://royalsociety.org/topics-policy/projects/climate-change-evidence-causes/question-6/>.

11 "Understanding Global Warming Potentials," U.S. Environmental Protection Agency, Updated April 18, 2023, <https://www.epa.gov/ghgemissions/understanding-global-warming-potentials>.

increase the proportion of water in the atmosphere, which is also a greenhouse gas. As ice melts or is darkened by carbon pollution, the average reflectivity ("albedo") of the Earth is reduced, absorbing more solar energy. Wildfires produce pollution, decrease forests' ability to pull CO_2 from the atmosphere, and produce additional greenhouse gas emissions. These positive feedback loops contribute to an overall delay in the total warming effects of greenhouse gas emissions of at least a decade. This means that current warming is mostly the product of 20th century emissions, and that even immediate, drastic changes in global emissions will likely not cause increasing temperatures to level-off until the mid 21st-century.[12] Increasingly precise experiments and computer models continually update projections but most models from decades ago skillfully predicted warming consistent with modern observations.[13] Thorough and detailed summaries of the latest climate science and projections have been regularly issued by the United Nations since 1990.[14]

1.2 Not All Emissions Come from Fossil Fuels, but Fossil Fuels Are Still the Primary Threat

Some human activity results in methane or nitrous oxide that does not originate with fossil fuels. Livestock emit a greater fraction of carbon as methane than wildlife.[15] Landfills and manure produce methane and fertilizer releases nitrous oxide.[16] Such emissions are biproducts of inefficiencies and practices that can be reformed with modified fertilization practices and feed compositions, which are less disruptive than transitioning from fossil fuels.[17] While potent, these emissions are relatively short-lived in Earth's atmosphere compared to CO_2.[18] They require a different set of policies and constitute different types of risks than dependence on fossil fuels, and should therefore not distract from fossil fuels and deforestation as the fundamental imbalance that is directly imposed on the Earth's carbon cycle and the primary threats to the climate.

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12 B. H. Samset, J.S. Fuglestvedt, M. T. Lund, "Delayed Emergence of a Global Temperature Response After Emission Mitigation," *Nature Communications*, Vol. 11 (2020), <https://www.nature.com/articles/s41467-020-17001-1>.

13 Zeke Hausfather, Henri F. Drake, Tristan Abbott, Gavin A. Schmidt, "Evaluating the Performance of Past Climate Model Projections," Geophysical Research Letters, Vol. 47 (2019), <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2019GL085378>.

14 "History of the Convention," UNFCCC, <https://unfccc.int/process/the-convention/history-of-the-convention#Climate-Change-in-context>. Review their latest report and other publications from the Intergovernmental Panel on Climate Change (IPCC) for more detailed and comprehensive climate science summaries and updates.

15 "Methane Emissions Are Driving Climate Change. Here's How to Reduce Them," UN Environment Program, August 20, 2021, <https://www.unep.org/news-and-stories/story/methane-emissions-are-driving-climate-change-heres-how-reduce-them>.

16 Shu-Yuan Pan, Kung-Hui He, Kuan-Ting Lin, Chihhao Fan, Chang-Tang Chang, "Addressing Nitrogenous Gases from Croplands toward Low-Emission Agriculture," *Nature Climate and Atmospheric Science*, Vol. 5 (2022) <https://www.nature.com/articles/s41612-022-00265-3>.

17 Kang Sun, Huihui Liu, Huiyu Fan, Ting Liu, Chen Zheng, "Research Progress on the Application of Feed Additives in Ruminal Methane Emissions Reduction: A Review," *PeerJ*, Vol. 9 (2021), <https://peerj.com/articles/11151/>.

18 "Understanding Global Warming Potentials," U.S. Environmental Protection Agency, Updated April 18, 2023, <https://www.epa.gov/ghgemissions/understanding-global-warming-potentials>.

1.3 Why Fossil Fuels Are So Difficult to Replace

It is important to briefly describe why fossil fuels are so difficult to replace without government restriction. Hydrocarbon fossil fuels are energy dense fuels that come straight from the ground, like fully charged batteries. Liquid hydrocarbon fuels are easy to store, transfer, and transport and do not expire. Their combustion is co-fueled by ubiquitous atmospheric oxygen under manageable temperatures and pressures. The primary waste products, CO_2 and water vapor, are non-toxic and released into the atmosphere, leaving no waste in the vehicle. Perhaps most importantly, the inertia of global supply chains, energy infrastructure, and fundamental business practices based on hydrocarbon fuels constitute significant sunk costs and sources of political resistance.

Hydrocarbons are also naturally water repellent and slippery, so they are valuable as materials like lubricants, plastics, roads, and shingles. Their high potential chemical energy makes them valuable chemical industry precursors in addition to fuels.

Conversely, metal batteries take no atmospheric inputs and emit no exhaust, representing self-contained dead weight. Unlike wind and solar energy, hydrocarbons can be stored and burned on demand. Hydrogen is a tiny molecule that is difficult to contain and manipulate and requires energy to produce. Ammonia engines have long struggled to mitigate NO_X emissions.

Biofuels represent a theoretically carbon-negative path to the same hydrocarbons sourced from fossil fuels but with carbon that originates in the atmosphere. As "drop-in fuels," some would require little change to existing infrastructure. Industrially relevant enzymes may soon be discovered that turn indigestible plant material into hydrocarbon fuels. However, like any alternative energy solution, it will require decades of large-scale research and development that will not receive sufficient investment as long as they are forced to compete with fossil fuels that externalize their true costs. In the meantime, today's biofuels like ethanol or seed oils are expensive, good for little more than fuel additives, and often compete with food production for agricultural land.[19]

None of this is to say that there are not viable alternatives for most if not all applications of fossil fuels. Alternatives like wind and solar have even become the cheapest new energy sources in many locations.[20] However, like WMD, fossil fuels enjoy too many inherent advantages for individual and state users to forgo without significant supply-side and demand-side controls driven by international pressure. Fossil fuels are too cheap and useful to be supplanted by technological innovations anytime soon, if ever, without such policies to avert far greater collective costs.

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19 Johnathan Holladay, Zia Abdullah, and Joshua Heyne, "Sustainable Aviation Fuel, Review of Technical Pathways Report," U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, September 9, 2020, <https://www.energy.gov/sites/prod/files/2020/09/f78/beto-sust-aviation-fuel-sep-2020.pdf>.

20 Michael Taylor, Pablo Ralon, Sonia Al-Zoghoul, "Renewable Power Generation Costs in 2021," International Renewable Energy Agency, Abu Dhabi, 2022, <https://www.irena.org//media/Files/IRENA/Agency/Publication/2022/Jul/IRENA_Power_Generation_Costs_2021.pdf?rev=34c22a4b244d434da0accde7de7c73d8>.

1.4 Quantifying the Impacts of Climate Change

The effects of climate change vary by region.[21] They generally include exacerbated weather extremes and higher sea levels due to melted ice that was sequestered on the Antarctic continent. Even a slight increase in average global temperatures drives more frequent and severe heat waves, droughts, wildfires, and storms. This causes expensive damage to infrastructure, increases public health threats like malaria and other infections, destroys housing and other developments, threatens food security, drives migration, and increases the chances of global conflict.

Climate impacts are projected to increase exponentially as fossil fuels continue to be burned and positive feedback loops are exacerbated. Rising seas will more frequently and severely flood coastal developments, threatening hundreds of millions of people and roughly USD $10 trillion in global assets.[22]

Increased drought, heat, and winds have significantly increased the frequency and damage of wildfires, witnessed recently in Australia, Canada, and the western U.S.[23] The market has responded. In June 2023, insurance companies State Farm and AllState announced that they would no longer insure new homes in California due to the state-wide risks of wildfires.[24]

Scientists have long attempted to quantify the global costs of GHG emissions with a single number called the "social cost of carbon."[25] This is an estimation of the financial cost that is inflicted on the world for every ton of CO_2e emitted into the atmosphere. Estimates range from the dozens to thousands of dollars per ton of CO_2e emissions.[26] As emissions compound, the cost increases every year. Rennert *et al*. recently calculated a social cost of carbon of USD

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21 H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama, et al., "Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change," IPCC, 2022, Cambridge University Press, <https://www.ipcc.ch/report/ar6/wg2/>.

22 Ibid.

23 Hicke, J.A., S. Lucatello, L.D., Mortsch, J. Dawson, M. Domínguez Aguilar, C.A.F. Enquist, E.A. Gilmore, D.S. Gutzler, S. Harper, K. Holsman, E.B. Jewett, T.A. Kohler, and K. Miller, "North America," In: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change," IPCC 2022, Cambridge University Press, pp. 1929-2042, <https://www.ipcc.ch/site/assets/uploads/2018/02/ar4-wg2-chapter14-1.pdf>.

24 Michael Finney, "Allstate Halting Home Insurance Policies in California Due to Wildfire Risk," *ABC7 Los Angeles*, June 3, 2023, <https://abc7.com/farmers-insurance-state-farm-allstate-home-wildfire/13339513/>.

25 Pei Wang, Xiangzheng Deng, Huimin Zhou, Shangkun Yu, "Estimates of the Social Cost of Carbon: A Review Based on Meta-Analysis," *Journal of Cleaner Production*, Vol. 209 (2019), pp. 1494-1507, <https://www.sciencedirect.com/science/article/pii/S0959652618334589>.

26 Ibid.

$185 per ton of CO_2e, which is consistent with previous studies.[27,28] This equates to USD $6 trillion in economic damage as a result of 2022 global emissions.[29] In 2022, the U.S. EPA has proposed increasing its working figure from USD $51 to USD $190 per ton of CO_2e emissions.[30] Unfortunately, these estimations tend to only count the most predictable and quantifiable climate impacts, excluding significant but ambiguous impacts like increased conflict, disease, and loss of human life and wellbeing. Therefore, the "real" social cost of carbon is almost certainly higher.

The World Health Organization (WHO) projects 250,000 excess deaths per year starting in 2030 as a result of malnutrition, malaria, diarrhea, and heat stress caused by the climate impacts of burning fossil fuels.[31] This is comparable to a nuclear attack on a major city every year. However, the WHO only considers a subset of climate impacts on public health, so human deaths are likely to be much higher.

Bressler proposed a "mortality cost of carbon" of 0.000226 deaths per metric ton of CO_2e emissions, equating to 1.35 million excess deaths as a result of the nearly 6 million tons of CO_2e emitted in 2020.[32] Even that figure does not consider human wellbeing in the context of public health, economic opportunity, child welfare, and civil society, which are harder to assess than mortality alone. By definition, climate change permeates all aspects of life on Earth.

Mortality increases significantly considering the long-term impact of a single year of emissions, even in the most optimistic scenarios by which we reach net neutrality in 2050. One year of global emissions, nearly 6 million metric tons of CO_2e, causes 1.35 million excess deaths over the next 80 years.[33] A single large coal plant that produces roughly 10 million tons of CO_2e per year results in over 2,200 excess deaths due to global climate impact alone, which is more than all estimated deaths from Syrian chemical attacks in the past two decades.[34] The average, individual American's lifetime emissions are projected to kill 0.29 people in a baseline scenario

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27 Kevin Rennert, et al., "Comprehensive Evidence Implies a Higher Social Cost of CO_2," *Nature*, Vol. 610 (2022), pp. 687-692, <https://www.nature.com/articles/s41586-022-05224-9>.

28 Pei Wang, Xiangzheng Deng, Huimin Zhou, Shangkun Yu, "Estimates of the Social Cost of Carbon: A Review Based on Meta-Analysis," *Journal of Cleaner Production*, Vol. 209 (2019), pp. 1494-1507, <https://www.sciencedirect.com/science/article/pii/S0959652618334589>.

29 Calculated based on global emissions totals from the International Energy Agency, <https://www.iea.org/reports/co2-emissions-in-2022>.

30 Elijah Asdourian, David Wessel, "What Is the Social Cost of Carbon?" Brookings Commentary, March 13, 2023, <https://www.brookings.edu/articles/what-is-the-social-cost-of-carbon/>.

31 "Climate Change and Health," World Health Organization, October 30, 2021, <https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health>.

32 R. Daniel Bressler, "The Mortality Cost of Carbon," *Nature Communications*, Vol. 12 (2021), <https://www.nature.com/articles/s41467-021-24487-w>.

33 Ibid.

34 Debarati Guha-Sapir, et al., "Civilian Deaths from Weapons Used in the Syrian Conflict," *BMJ*, Vol. 351 (2015) <https://www.bmj.com/content/351/bmj.h4736.full>.

vs. 0.14 people in an optimistic, 2050 carbon net-neutrality scenario.[35]

Fossil fuels are also a direct danger to human life and wellbeing, even beyond their impact on the climate. A meta-analysis estimates 10.2 million premature deaths per year merely because of particulate pollution from fossil fuels.[36] Additional deaths and negative impacts result from their mining, refining, storage, and transportation. They include oil spills on land and sea, respiratory disease, natural gas leaks and explosions, and refinery fires. While these potentially constitute larger, more direct impacts of fossil fuels than climate change, they do not have the long-term compounding impacts of GHG emissions.

Part 2: Fossil Fuel Nonproliferation

2.1 Why Treat Fossil Fuels Like Weapons of Mass Destruction?

This framing is nothing new, as authoritative national security institutions describe the preeminent perils of climate change as a direct threat.[37,38,39,40,41] Unfortunately, cultural norms that categorize climate change as an economic, environmental, or politically hot-button issue disincentivize strategic investments in climate expertise by security professionals and trade control institutions. The buck is being passed to climate activists, economists, and technologists while all communities pay the price. Instead, framing climate change as a security threat facilitates cooperation between stakeholders and socializes underappreciated policy options and implementation challenges. It increases recognition by the security community of climate change in addition to climate's integral role in traditional security threats.

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35 R. Daniel Bressler, "The Mortality Cost of Carbon," *Nature Communications*, Vol. 12 (2021), <https://www.nature.com/articles/s41467-021-24487-w>.

36 Karn Vohra, et al., "Global Mortality from Outdoor Fine Particle Pollution Generated by Fossil Fuel Combustion: Results from GEOS-Chem," *Environ Res*., Vol. 195 (2021), <https://pubmed.ncbi.nlm.nih.gov/33577774/>.

37 Emyr Jones Parry, "The Greatest Threat to Global Security: Climate Change is Not Merely an Environmental Problem," *UN Chronicle*, Vol. XLIV (2007), <https://www.un.org/en/chronicle/article/greatest-threat-global-security-climate-change-not-merely-environmental-problem>.

38 U.S. Secretary of Defense, Lloyd J. Austin III, "Climate Change is an Existential Threat to Our Nation's Security, and the Department of Defense Must Act Swiftly and Boldly to Take on This Challenge," October 7, 2021, <https://www.defense.gov/News/Releases/Release/Article/2803761/statement-by-secretary-of-defense-lloyd-j-austin-iii-on-the-department-of-defen/>.

39 Michael Brzoska, "Climate Change and the Military in China, Russia, the United Kingdom, and the United States," *Bulletin of the Atomic Scientists*, Vol. 68 (2012), <https://journals.sagepub.com/doi/pdf/10.1177/0096340212438384>.

40 Arnaud Boehmann, "National Security and the Climate Crisis – China Is Still Not Joining the Dots," Mercator Institute for China Studies, December 21, 2022, <https://merics.org/en/comment/national-security-and-climate-crisis-china-still-not-joining-dots>.

41 Andrew R. Hoehn, Thom Shanker, "Climate Security is National Security," The Rand Blog, June 30, 2023, <https://www.rand.org/blog/2023/06/climate-security-is-national-security.html>.

Regulating the international sale and use of fossil fuels requires leadership from institutions which govern international borders. Customs institutions and strategic trade management officials constitute the infrastructure that has long countered traditional proliferation threats. Building on such existing infrastructure, rather than reinventing it for climate change, is not only an efficient use of bureaucracy, it is key to achieving the necessary speed of climate policy implementation.

Another reason to treat fossil fuels as proliferation threats is the common historic role of moral authority in driving collective action. Countries like South Africa and Ukraine voluntarily surrendered nuclear weapons, motivated and defended on the basis of moral, political, and internationalist goals and norms.[42,43] The establishment of such norms further empowers policies that coerce holdouts into compliance. The same goals of securing collective wellbeing that drove nonproliferation treaties and control regimes established the Kyoto Protocol, Montreal Protocol, and Paris Agreement. In all cases, countries are pushed to surrender selfish interests to take collective action. Once such norms take hold, aligned countries undertake the technically challenging work of multilateral negotiation, control lists, and enforcement strategies. This further provides an onramp for unaligned countries, which face barriers to technology and trade as a result of their non-alignment. Modern multilateral export control regimes like the Nuclear Suppliers Group, Australia Group, Missile Technology Control Regime, and Wassenaar Arrangement serve such functions, and similar regimes can do the same for trade controls on fossil fuels. This history sets the precedence and political road map for how moral authority and norms can result in international collective action and the acceptance of not just economic, but national security costs.

Over the past decade, strategic planners and think tanks have invested in the intersection of climate change and security, regarding climate change as either an exacerbating factor of ongoing security threats or a direct security threat itself.[44,45,46,47] Nuclear winter and climate change are recognized as closely-related and interconnected "twin existential threats" by organizations like the International Campaign to Abolish Nuclear Weapons (ICAN), International Physicians for the Prevention of Nuclear War, the Council for a Livable World, and recently President

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42 Uri Friedman, "Why One President Gave Up His Country's Nukes," *The Atlantic*, September 9, 2017, <https://www.theatlantic.com/international/archive/2017/09/north-korea-south-africa/539265/>.

43 Sherman W. Garnett, "Ukraine's Decision to Join the NPT," *Arms Control Today* (1995), republished at <https://www.armscontrol.org/blog/2014-03-08/ukraine-russia-npt>.

44 U.S. Executive Order 14008, 2022 U.S. National Security Strategy, 2022 U.S. National Defense Strategy.

45 "A New Outlook on the Climate and Security Nexus: Addressing the Impact of Climate Change and Environmental Degradation on Peace, Security and Defense," European Commission High Representative of the Union for Foreign Affairs and Security Policy, Brussels, June 6, 2023, <https://www.eeas.europa.eu/sites/default/files/documents/2023/JOIN_2023_19_1_EN_ACT_part1_v7.pdf>.

46 "The World Climate and Security Report 2021," International Military Council on Climate and Security, June 2021, <https://imccs.org/wp-content/uploads/2021/06/World-Climate-and-Security-Report-2021.pdf>.

47 Representative think tanks include The Center for Climate & Security, The Climate Security Expert Network, RUSI Climate, Energy and Environmental Security Research Program, Aspen Institute, Climate and National Security.

Biden.[48,49,50] These twin threats feature similarly outsized scales of externalized negative impacts to civilian populations at the discretion of users, who gain short term benefits. Climate change also increases the risk of conflict, including nuclear exchange, by driving destabilization, desperation, and despair.

Some biological threats and pandemics may pose a greater short-term threat to human life, but the impacts of climate change are longer-term and include direct damage to infrastructure in ways that pathogens do not. Climate change has no pharmacological or immunological remedy. Climate change is also an experienced reality, while pandemics and WMD attacks are probabilistic risks. Despite the language of climate "risk," which draws parallels with common nonproliferation jargon, fossil fuels are more comparable to ongoing WMD employment than risk of misuse.

Furthermore, there is no upper limit to exponential climate costs. On the planet Venus, a thick CO_2 atmosphere generates average surface temperatures that melt lead. On Earth, a CO_2-driven runaway greenhouse effect and global warming of 6ºC was key to the extinction of 95% of all species on Earth 251 million years ago.[51]

Are fossil fuels "weapons" used by "malicious actors?" No, they are not tactically used for the purpose of taking human life. However, both inflict global costs to achieve political or economic goals. After decades of UN climate reports, conferences, frameworks, treaties, and centuries of alarms from the scientific community, no credible claim of ignorance, denialism notwithstanding, can be made as to the global negative impacts of the burning of fossil fuels. Even so-called "malicious actors" believe that they employ weapons for legitimate reasons. Warfare is politics and economics by other means.[52] Is a coal plant any less fundamentally destructive to human wellbeing than a regime stockpiling WMDs? The damage of burning fossil fuels is willfully inflicted on global bystanders, and there is little economic or legal recourse for the victims. Therefore, claims that fossil fuels are legitimate sources of energy should be dismissed to the same extent as claims that WMDs are legitimate tools of war.

Can officials call for international action that exceeds domestic policy? In other words, can heads of state call for international fossil fuel restrictions that go far beyond domestic policy? Yes. Not only can the climate crisis not wait for domestic policies to catch up, trade controls are

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48 Council for a Livable World, "Twin Threats," <https://livableworld.org/nukes-climate-change/#:~:text=There%20are%20two%20serious%20threats,Both%20are%20preventable>.

49 International Physicians for the Prevention of Nuclear War, "Twin Existential Threats," <https://www.ippnw.org/programs/youth-engagement/twin-threats-nuclear-war-and-the-climate-crisis>.

50 Jordan Fabian, Akayla Gardner, "Biden Says Climate Change Poses Greater Threat Than Nuclear War," *Bloomberg News*, September 10, 2023, <https://www.bnnbloomberg.ca/biden-says-climate-change-poses-greater-threat-than-nuclear-war-1.1969474>.

51 M. J. Benton, R. J. Twitchett, "How to Kill (Almost) All Life: the End-Permian Extinction Event." Trends in Ecology and Evolution, Vol. 18 No. 7 (2003), <https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347(03)00093-4>.

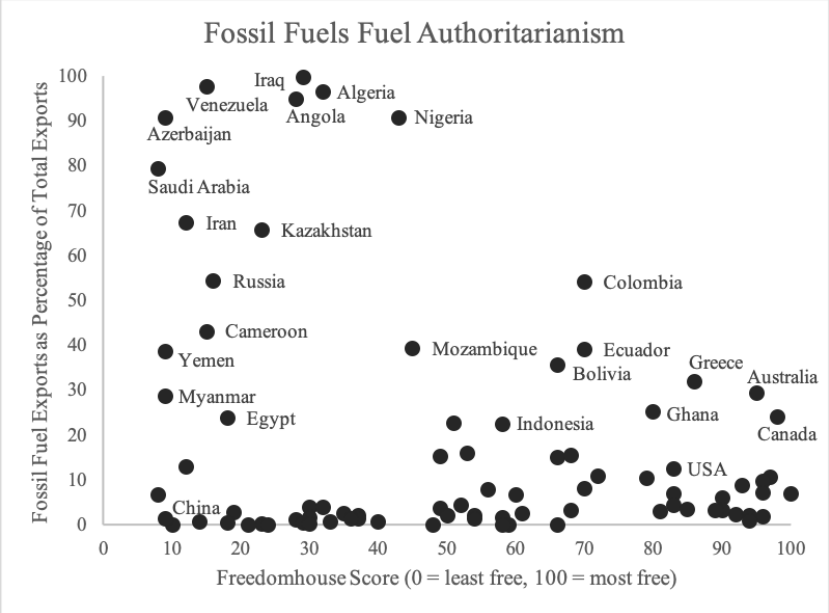
52 Referencing "War is not merely a political act, but also a real political instrument, a continuation of political commerce, a carrying out of the same by other means." From Carl von Clausewitz, "On War," translated by Col. J.J. Graham (2018), <https://oll.libertyfund.org/page/clausewitz-war-as-politics-by-other-means>.

an example of where it is common and expected for domestic policies to follow international negotiations. Without the alignment of all countries that export a potentially controlled technology, a unilateral export control would be ineffective and hurt the first mover. Sometimes a country can show leadership by instituting domestic policies before the world catches up, such as EU climate policies. However, it is not hypocritical to resist unilateral disarmament or the unilateral bearing of economic burdens while advocating for them in international negotiations. Similarly, domestic policies are also not necessarily reflective of political will to align with international agreements. Countries may be happy to restrict fossil fuels as long as they can be assured that their economic competitors and trading partners will bear similar burdens. See Section 4.3 for details on first-mover advantages and selfish economic incentives to restrict fossil fuels.

2.2 Fossil Fuels Fuel Authoritarianism

Countries that are most dependent on the export of fossil fuels are most likely to be ruled by authoritarian regimes (Figure 3). This is a valuable piece of political leverage in making climate progress. A political constituency may be unwilling to restrict fossil fuels for high-minded climate reasons but eager to reduce the economic power of its exporters. The synergies found in the European Union between security hawks and climate activists on the recent divestment from Russian oil and gas are an example of how this feature of fossil fuels can be politically leveraged.

Figure 3. Negative correlation between dependence on fossil fuel exports and Freedomhouse scores[53]



53 Percent of total merchandise exports (World Bank) in SITC Category 3, including petroleum, coal, oil, and natural gas, averaged over a 10yr period (2013-2022). Freedomhouse 2023 "Total" scores were used, only plotting countries with populations over 10 million (UN population data, 2022).

It is not known if the correlation between fossil fuel exports and authoritarianism is causal. However, easily accessed and exported natural resources like fossil fuels constitute easy value for an economy, which is not dependent on innovative, democratic economies and inclusive institutions and therefore may be inherently beneficial to authoritarian regimes.[54] Without domestic oil supplies, such regimes may be impoverished, or they may have been more dependent on inclusive, innovative institutions to thrive.

2.3 Precedence for Strategic Trade Management and Climate Change

A nonproliferation treaty already exists that controls environmentally damaging emissions. The 1987 Montreal Protocol stems the proliferation of ozone depleting substances and is generally touted as a success story in global collective action to control damaging emissions.[55] The 2016 Kigali Amendment, a treaty ratified by 151 states including the U.S. in 2022, imposes trade controls on additional fluorinated hydrocarbons that threaten the ozone layer and are powerful greenhouse gasses.[56] The text of the treaty specifically cites motives to combat climate change. Smuggling of such materials is countered by customs and border security officials, and licensing regimes govern and cap their legitimate trade.

The scope of export controls is dynamic and evolving. Recent innovations around the use of trade controls include investment screening, which recognizes cross-border finance as a proliferation threat. Moral authority is exercised through import restrictions like the U.S. refusal to import products from Xinjiang on the basis of slave labor.[57] The Wold Trade Organization (WTO) authorizes such actions in Article XX of the General Agreement on Tariffs and Trade (GATT), "General Exceptions," which would also apply to trade controls for the purpose of mitigating GHG emissions.[58,59] In fact, export and import controls on fossil fuels already exist in many countries, though usually in the form of export taxes, tariffs, and quotas designed to ensure domestic supplies.[60] These can serve as the basis for bureaucratic infrastructure and

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54 The concept of "inclusive" vs. "extractive" institutions described by Daron Acemoglu and James A. Robinson in "Why Nations Fail: The Origins of Power, Prosperity, and Poverty," Crown Currency, September 17, 2013, <https://www.amazon.com/Why-Nations-Fail-Origins-Prosperity/dp/0307719227>.

55 Richard McKenzie, et al, "Success of Montreal Protocol Demonstrated by Comparing High-Quality UV Measurements with 'World Avoided' Calculations from Two Chemistry-Climate Models," *Nature Scientific Reports*, Vol. 9 (2019), <https://www.nature.com/articles/s41598-019-48625-z>.

56 "Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer," Kigali, October 15, 2016, <https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXVII-2-f&chapter=27&clang=_en>.

57 "Section 307 and Imports Produced by Forced Labor," Congressional Research Service, July 26, 2022, <https://crsreports.congress.gov/product/pdf/IF/IF11360#:~:text=Section%20307%20of%20the%20Tariff,(CBP)%20enforces%20the%20prohibition>.

58 World Trade Organization, General Agreement on Tariffs and Trade (GATT), Article XX, "General Exemptions," <https://www.wto.org/english/res_e/booksp_e/gatt_ai_e/art20_e.pdf>.

59 Joachim Englisch, Tatiana Falcao, "EU Carbon Border Adjustments for Imported Products and WTO Law," SSRN (2021) <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3863038>.

60 Adam Vann, Daniel T. Shedd, Brandon J. Murrill, "Federal Permitting and Oversight of Export of Fossil Fuels," Congressional Research Service, September 17, 2013, <https://sgp.fas.org/crs/misc/R43231.pdf>.

subject matter expertise for broader trade controls.

2.4 The Supply-Side and Demand-Side Climate Policy Scissors

Supply-side policies, such as extraction restrictions and trade controls, reduce global supply, while demand-side policies, such as carbon taxes and cap & trade systems, impose higher prices to reduce demand.[61,62] Both are designed to build sustainable, long-term fossil fuel markets that gradually raise prices and reduce consumption, making alternative technologies increasingly competitive over the long term.

Each type of policy is threatened by freeloaders. When fossil fuel supply is restricted, freeloading producers can take advantage of high prices and reduced competition. When demand is restricted by carbon pricing, freeloading producers can evade pricing to gain a market advantage and externalize their climate costs. Each set of policies mitigates the freeloader impacts of the other, which is why they have been described as complimentary policy "scissors" to cut global emissions.[63] However, they leverage very different bureaucratic mechanisms and domains of expertise.

"Carbon leakage" is a term for emissions that bypass such policies, such as an emitter that evades a carbon tax or unlicensed transshipment of fossil fuels.[64] Leakage not only undermines the overall effectiveness of the policy, it rewards greenhouse gas (GHG) emitters at the expense of regulating economies, thwarting international progress. Leakage is not necessarily the result of illegal behavior but results from the "reshuffling" of emissions outside the scope of pricing or trade controls.[65] Reshuffling is not limited to climate policy. China is leveraging cloud services to evade U.S. export controls on semiconductors, reshuffling its processing needs to evade this restriction.[66]

The ultimate goal of supply-side and demand-side policies is to allocate a decreasingly permissible supply of fossil fuels to end-users of greatest need, minimizing economic and developmental disruption while maximizing the speed of transition from fossil fuels. Demand-

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61 G.B. Asheim, et al, "The Case for a Supply-Side Climate Treaty," *Science*, Vol. 365 (2019), pp. 325–327 <https://www.science.org/doi/10.1126/science.aax5011>.

62 Michael Lazarus, Harro van Asselt, "Fossil Fuel Supply and Climate Policy: Exploring the Road Less Taken," *Climate Change*, Vol. 150 (2018), pp. 1–13, <https://link.springer.com/article/10.1007/s10584-018-2266-3>.

63 Fergus Green and Richard Denniss, "Cutting with Both Arms of the Scissors: The Economic and Political Case for Restrictive Supply-Side Climate Policies," *Climate Change*, Vol. 150 (2018), pp. 73–87, <https://link.springer.com/article/10.1007/s10584-018-2162-x>.

64 David A. Weisbach, Samuel S. Kortum, Michael Wang, Bella Yao, "Trade, Leakage, and the Design of aarbon Tax," *SSRN,* (2022), <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4328827>.

65 Christoph Böhringer, Carolyn Fischer, Knut Einar Rosendahl, Thomas Fox Rutherford, "Potential Impacts and Challenges of Border Carbon Adjustments" *Nature Climate Change*, Vol. 12 (2022), pp. 22–29, <https://www.nature.com/articles/s41558-021-01250-z>.

66 Eleanor Olcott, Qianer Liu, Demetri Sevastopulo, "Chinese AI Groups Use Cloud Services to Evade S. Chip Export Controls," Financial Times, March 8, 2023, <https://www.ft.com/content/9706c917-6440-4fa9-b588-b18fbc1503b9>.

side policies and extraction restrictions both rely on market principles to allocate fossil fuels to those who are willing and able to pay higher prices. However, should willingness to pay be the only factor in allocating GHG emissions? Imagine a drug clinic that auctioned methadone to its highest paying patients. Supply-side trade controls enable a more deliberate allocation of fossil fuels to trading partners of highest need and to end-users and for end-uses that make the most modest climate impact in the short and long term.

Part 3: Supply-Side Strategic Trade Controls

3.1 Licensing Considerations for Climate Trade Controls

The following section contains a 7-part supply-side framework by which export licenses for fossil fuels or related materials could be assessed across a spectrum of climate risk weighed against humanitarian and other interests. Because most countries already enforce export controls on dual-use materials, this policy could be integrated into existing regimes by including fossil fuels on controls lists and explicitly considering a framework of relative climate impact as the basis for licensing decisions.

3.1.1 Distinguishing Between Fossil Fuels, Technologies, and End-Uses

Coal is the dirtiest fossil fuel. Burning less efficiently, it produces nearly twice as much CO_2 per unit of energy as natural gas and far more particulate pollution.[67] Coal exports are inherently high risk, especially for the importer, with local populations bearing the brunt of pollution.[68] Natural gas produces more energy per ton of CO_2e emissions, and therefore more modest climate impacts as an energy source. However, it is still a fossil fuel and should not be mistaken for a climate solution. In addition to producing GHG emissions, its primary component of methane is a much more potent greenhouse gas when leaked or incompletely burned.[69]

Drilling, mining, and refinery technology could be the most appealing goods to control because they are inherently sought for new fossil fuel extraction and investment in future fossil fuel infrastructure. Because more fossil fuel sources have already been developed than can be burned to keep warming under 1.5 ºC, exports of any drilling or mining technology should be banned if there is sufficient risk that they will be used to extract fossil fuels.[70] Long term climate risk can be mitigated by tightly controlling such technology and heavily restricting its transshipment. Like other dual-use materials, drilling and mining technology can be used

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67 "Overview of Greenhouse Gases," U.S. Environmental Protection Agency, Updated August 25, 2023, <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>.

68 Karn Vohra, et al., "Global Mortality from Outdoor Fine Particle Pollution Generated by Fossil Fuel Combustion: Results from GEOS-Chem," *Environ Res*., Vol. 195 (2021), <https://pubmed.ncbi.nlm.nih.gov/33577774/>.

69 "Understanding Global Warming Potentials," U.S. Environmental Protection Agency, Updated April 18, 2023, <https://www.epa.gov/ghgemissions/understanding-global-warming-potentials>.

70 Dan Welsby, James Price, Steve Pye, Paul Ekins, "Unextractable Fossil Fuels in a 1.5 °C World," *Nature*, Vol. 597 (2021), pp. 230–234, <https://www.nature.com/articles/s41586-021-03821-8>.

for geothermal systems or mining metals to produce batteries. These applications should be encouraged. Therefore, robust end-user and transshipment risk assessments are warranted, like with dual-use technologies. Fossil fuel extraction end-uses should be highly restricted, while end-uses such as geothermal projects and metal mining should be permissively licensed as long as risk in secondary markets is mitigated.

While trade controls on fossil fuels are the primary focus of this article, deforestation and agricultural are valid secondary targets for mitigating climate change (See section 1.2). For controlling the other side of the carbon cycle, trade officials can crack down on trade in illegal timber, raising burdens of proof that it was sustainably sourced. Like drilling technology, deforestation equipment can be tightly controlled while permitting legitimate end-uses in sustainable timer farming. This requires end-user investigations and assessments of transshipment and other secondary market risks.

Agriculture is one of the most powerful forces behind deforestation, so agricultural products known to be drivers of deforestation are good targets for control. For example, Brazilian beef and soy are some of the biggest drivers of rainforest destruction, so import restrictions on these products on the basis of climate risk, causing producers to lose market access, could motivate Brazil to take domestic action against deforestation.[71] Such a policy would be similar in principle to U.S. banned imports produced via forced labor.

3.1.2 Efficiency and Application

The greater the efficiency of combustion, the lower the relative climate impact. Steel and concrete manufacturing are energy intensive and can vary widely in terms of energy efficiency and climate impact.[72] Unwanted biproducts are also a concern. Any combustion done in the presence of air, mostly nitrogen gas, produces NO_X gasses, which are powerful GHGs.[73] This is mitigated by catalytic converters, compelled by vehicle emissions standards.[74] Therefore, the importing country's regulatory environment is highly relevant to determining climate impact of exports.

Asphalt, lubricants, and plastics are derived from crude oil but are not burned to release greenhouse gasses. So, such end-uses could be considered low risk and more easily licensed than fuels. However, crude oil is a complex mixture, and there are few fractions that can be used for both fuels and materials. Most oil refinement is incentivized to maximize the

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71 World Wildlife Foundation, "What are the Biggest Drivers of Tropical Deforestation?" *World Wildlife Magazine*, Summer 2018, <https://www.worldwildlife.org/magazine/issues/summer-2018/articles/what-are-the-biggest-drivers-of-tropical deforestation#:~:text=The%20food%20behind%20deforestation,beef%20and%20other%20animal%20proteins>.

72 "Industry," International Energy Agency, Updated July 11, 2023, <https://www.iea.org/energy-system/industry>.

73 "Overview of Greenhouse Gases," U.S. Environmental Protection Agency, Updated August 25, 2023, <https://www.epa.gov/ghgemissions/overview-greenhouse-gases>.

74 "Nitrogen Oxides (NOx) Control Regulations," Environmental Protection Agency, <https://www3.epa.gov/region1/airquality/nox.html>.

production of gasoline and diesel, which are in highest demand.[75] Restricting fuel fractions rather than material fractions may simply reshuffle refined products, resulting in little overall climate impact. However, non-combustion applications may be considered exempt from export restriction if the wholistic climate impact of the supply chain is minimal. In short, it is a factor, but not a determining factor.

The efficiency of downstream processing is also an important assessment in evaluating relative climate risk. For example, "coking" is an energy intensive process in crude oil refinement that breaks larger hydrocarbons into smaller molecules like gasoline and diesel fuel. Refineries that electrify or skip this process could represent more favorable end-users.[76] The heavier coke is still used as industrial fuel, but emissions reductions are gained from skipping the process. Gasoline and diesel are also the most profitable fractions, so end-users that skip this upscaling to vehicle fuels will reduce supplies of those fuels and help to shift the domestic market away from combustion vehicles. However, like with materials, the impacts of such policies can be complex, so a wholistic "lifecycle analysis" is warranted. This is a highly technical, complex, and data-intensive field of analysis. Licensing authorities would be wise to invest in this capability as it is also required for border adjustment taxes discussed in Part 4 of this article about demand-side policies.

3.1.3 Carbon Capture

Carbon capture, an emerging technology associated with fossil fuel burning power plants, attempts to sequester greenhouse gas emissions to neutralize climate impacts. In some cases, CO_2 is stored by being trapped underground or turned into solid salts. Such end-users could be judged as relatively low-risk, but with three important considerations: First is the extent to which greenhouse gasses are truly captured or escape into the atmosphere. Second is the extent to which the captured carbon can be *indefinitely* sequestered from the atmosphere. Ground-based sensors coupled with satellite imagery can help to monitor both types of leakage, but the latter is on time scales too long to practically inform export licensing decisions. The third is the net benefit of carbon capture based on lifecycle analysis. For example, if the mining or refining of salts required to capture carbon emits as much carbon as is captured, there is no net mitigation.

This is early stage technology. Permissive licensing to end-users that employ carbon capture may incentivize improvements in such technology. However, skepticism is justified to avoid reinforcing or "greenwashing" continued fossil fuel dependence. None of the various competing carbon capture technologies has overcome all associated challenges.[77] Even at their theoretical best and proven at industrial scales they represent short-term improvements rather

75 Harold H. Schobert, *Chemistry of Fossil Fuels and Biofuels* (Cambridge: Cambridge University Press, 2013).

76 Drew Veysey, Meghan Peltier, Joseph Fallurin, "Five Ways U.S. Oil Refineries Can Reduce Emissions Today," RMI, June 5, 2023, <https://rmi.org/how-to-slash-refinery-emissions-quickly-washington-state/>.

77 Aseem Dubey, Akhilesh Arora, "Advancements in Carbon Capture Technologies: A Review," *Journal of Cleaner Production*, Vol. 373 (2022), <https://www.sciencedirect.com/science/article/abs/pii/S0959652622035041>.

than sustainable energy solutions. Therefore, modest consideration and a high burden of proof are warranted for carbon capture in licensing decisions.

3.1.4 Spillage and Pollution

An end-user that shows a history or risk of spilling crude oil or leaking natural gas should be considered relatively high risk and one of the least likely to receive a licensed export of fossil fuels. Not only do they constitute environmental and humanitarian disasters, they harm the climate significantly more than mere combustion. Leaked natural gas, methane, has 29.8 times the climate impact in the atmosphere as CO_2. Spilled oil destroys ecosystems that sequester carbon.

Other practices to mitigate climate harms, beyond carbon capture, include practices like diverting air traffic to minimize contrail emissions.[78,79] Such end-users may be rewarded in licensing risk assessments.

3.1.5 Energy Transition Plans and Quotas

A country's general fossil fuel dependence, infrastructure, and policy landscape are significant considerations of climate risk of individual exports and imports. A country with a record of progress and a clear and compelling strategy to permanently transition away from fossil fuels is a relatively low-risk importer of fossil fuels, because there is a reduced risk of long-term dependence. Conversely, supplying new or entrenched fossil fuel infrastructure is high risk.
An end-user that plans to burn fossil fuels for short-term applications is relatively low risk. Examples could include supplying an aged power plant until a solar farm comes on line, responding to a short-term disaster that impacts other sources of energy, or geopolitical interests like supplying the European Union (EU) as it weans itself off of Russian natural gas.

An analogy to a patient suffering from addiction is appropriate. A fossil fuel exporter, like a methadone prescriber, has a responsibility to wean its customers off of fossil fuels. This analysis would take into consideration the country's overall trade and economic landscape, development goals, and political appetite for transition. Limiting fossil fuel exports is the stick, while the policy carrot could include green energy technology transfers, financing, partnerships with third parties, and assistance in developing energy transition plans and carbon pricing schemes, discussed in Part 4 of this article.

Corporate exporters are rarely incentivized to limit their customer base, which is the raison d'être for all government trade restrictions. Fortunately, trade licensing is among the regulations least subject to public scrutiny, providing political cover to regulators.

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78 D. S. Lee, et al, "The Contribution of Global Aviation to Anthropogenic Climate Forcing for 2000 to 2018," *Atmospheric Environment*, Vol. 244 (2021), <https://www.sciencedirect.com/science/article/pii/S1352231020305689>.

79 Roger Teoh, Ulrich Schumann, Arnab Majumdar, Marc E. J. Stettler, "Mitigating the Climate Forcing of Aircraft Contrails by Small-Scale Diversions and Technology Adoption," *Environmental Science and Technology*, Vol. 54 (2020), <https://pubs.acs.org/doi/10.1021/acs.est.9b05608>.

A fossil fuel quota, limiting annual total exports to a country rather than scrutinizing individual end-users, is a useful tool to minimize administrative burdens and enable the importing country to make the best use of limited imports. If willing to cooperate, the importing country can allocate this limited supply on its own terms with domestic demand-side policies and green technology investments. Dynamic quotas can reward national progress and play a larger part of bilateral or multilateral negotiations. This is most important for countries who rely on fossil fuel imports from a limited number of partners. A fossil fuel exporter could simply deduct from its quota any fossil fuels supplied by alternative countries, forcing it to reduce consumption rather than simply shift to alternate suppliers. Policies such as export quotas and transition assistance can be negotiated as part of broader trade and climate negotiations.

3.1.6 Transshipment Risk

Current fossil fuel markets are relatively unrestricted, including both legal pipelines and illegal ship-to-ship transfers.[80] As a nearly ubiquitous raw material, fossil fuels constitute part of a complex supply chain. Therefore, transshipment is an even more important consideration than with most dual-use materials. Crude oil is often imported simply to be refined and re-exported. The nature of these complex supply chains complicates any end-user analysis. Similarly, the export of drilling and transportation equipment should consider the landscape of end-users of the resulting fossil fuels and higher-order impacts on global markets. Like quotas, prohibitions or controls on transshipment for some countries may be ways to limit fossil fuel dependence or mitigate overall risk without denying the export.

3.1.7 Broader Economic and Development Contexts

Climate impact should be weighed against humanitarian and developmental interests. Developed economies have the highest historic emissions and the highest modern per capita emissions.[81] The long-established United Nations principle of "differentiated responsibility" asserts that these economies should bear the greatest burden in mitigating and adapting to climate change and have committed to providing assistance for climate adaptation, although those commitments have not been met.[82] Unfortunately, the world cannot endure developing economies going through the same cycle of fossil fuel driven development, so it is up to the developed world to finance and transfer technology that enables developing economies to

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80 Yulia Erport, Tomer Fadlon, "Economic Maneuvering: How States Evade Economic Sanctions," *Strategic Assessment*, Vol. 26 (2023), pp.90-109, <https://www.inss.org.il/wpcontent/uploads/2023/09/Adkan26.2_Eng_4.pdf#page=92>.

81 H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama, et al., "Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change," IPCC, 2022, Cambridge University Press, <https://www.ipcc.ch/report/ar6/wg2/>.

82 "Adaptation Gap Report 2022," UN Environment Programme, November 1, 2022, <https://www.unep.org/resources/adaptation-gap-report-2022>.

leapfrog fossil fuels in favor of clean alternatives.[83]

Export licensing authorities can work to facilitate this type of trade in renewable energy technology as much as possible. Developed countries like the U.S. and China have the edge on low-carbon technology products and stand to benefit most from a growing demand for renewables.[84]

Export licensing authorities do not decide how much assistance is provided to developing economies, wielding a stick rather than carrot. To the extent that least developed countries are not provided sufficient support, export authorities could decrease fossil fuel licensing to developed economies as a way to both compel greater climate assistance from those countries and as a way to supply developing economies with fossil fuels without raising global emissions.

Licensing decisions based on climate impact exist within a broader set of global priorities. As case-by-case licensing of fossil fuels gains traction, trade officials would be wise to set licensing standards like country quotas and efficiency standards as a part of broader trade policy. Such standards will enable licensing decisions to be more predictable, fair, and practical than those made on an initial case by case basis. Fairer and more sustainable still, all countries should strive for multilaterally aligned controls on fossil fuels, but first, such controls must be normalized through unilateral action.

Some may argue that developing economies should not face fossil fuel restrictions unless and until such assistance is provided by developed countries, the worst emitters. However, given the urgent need for climate mitigation and the fact that developing countries are most vulnerable to climate change, it is important that this climate-justice argument *not* serve as an excuse to slow fossil fuel restrictions. Instead, fossil fuels should be restricted as fast as possible and countries that are not meeting their obligations to support developing economies in their transition should be compelled to do so by economic sanctions, which may include limited access to fossil fuels. The risk of insufficient development assistance is worth accepting for the sake of speed and scale in fossil fuel restrictions. Grand international bargains take too much time, which is why this article describes policies that can be relatively fast, unilateral, politically sheltered, and incentivize multilateral progress.

3.2 Next Steps on Climate Trade Controls

The main advantages of imposing such climate-driven trade controls are the following:

- They are easy to integrate into existing trade control and licensing regimes, especially controls on dual-use materials;

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83 Kyle S. Herman, "Green Growth and Innovation in the Global South: A Systematic Literature Review," *Innovation and Development*, Vol. 13 (2021), pp. 43–69, <https://doi.org/10.1080/2157930x.2021.1909821>.

84 "Advanced Economies Maintain Comparative Advantage in Exports of Low Carbon Technology Products," International Monetary Fund, Climate Change Dashboard, 2021, <https://climatedata.imf.org/>.

- They may already be authorized by legislation on dual-use controls or policies to secure domestic supplies of fossil fuels;

- Export controls are relatively politically palatable to domestic populations, limiting supply and raising prices in foreign countries instead of their own;

- Export controls may decrease domestic energy prices due to export restrictions.

Unfortunately, without demand side policies, carbon leakage would be a significant limiter of climate progress, especially in today's relatively permissive and liquid fossil fuel market where alternate suppliers are easy to come by. Export controls do nothing to regulate domestic markets and can even be counterproductive by increasing domestic supply and lowering prices. Import controls, while subject to the same logic of emissions reductions, are damaging to the importing country. Carbon pricing, discussed in Part 4 of this article, would be a more effective and even lucrative solution.

In today's permissive market, export controls make sense as a proof-of-concept demonstration of progress and an establishment of new norms. In a future when most suppliers impose such restrictions, they will be far more effective and coercive on the remaining climate holdouts. Therefore, while unilateral controls could impose some costs on the worst polluters, they are merely first steps toward more effective multilateral controls.

This same type of transition occurred in the history of nonproliferation policy and the maturation of multilateral control regimes and treaties. Dual-use controls have little impact when there are plenty of alternate suppliers without restrictions. One of the key differences is that nonproliferation treaties like the NPT were enacted before most countries were widely using, producing, buying, and selling nuclear materials. While the mechanisms and multilateralism of the nonproliferation movement are models for climate progress, reaching the international commitment of net carbon neutrality by 2050 requires even more stringent controls to virtually end fossil fuel combustion in less than 30 years.

3.3 Institutions of Interest

The WTO framework distinguishes between climate mitigation and economic protectionism. Trade controls designed to reduce greenhouse gas emissions like export restrictions, tariffs, and quotas are consistent with the World Trade Organization General Agreement on Tariffs and Trade (GATT), Article XX, General Exemptions: "(b) necessary to protect human, animal, or plant life or health".[85] Because there is significant juris prudence to justify the use of this exemption in environmental protection, mitigating climate change should be an easy sell as a valid exemption.[86] However, as trade controls such as those discussed in this article become

85 World Trade Organization, General Agreement on Tariffs and Trade (GATT), Article XX, "General Exemptions," <https://www.wto.org/english/res_e/booksp_e/gatt_ai_e/art20_e.pdf>.

86 Christoph Böhringer, Carolyn Fischer, Knut Einar Rosendahl, Thomas Fox Rutherford, "Potential Impacts and Challenges of Border Carbon Adjustments" *Nature Climate Change*, Vol. 12 (2022), pp. 22–29, <https://www.nature.com/articles/s41558-021-01250-z>.

increasingly common and powerful, this exemption will face many tests. Other exemptions, such as "the conservation of exhaustible resources" have been leveraged in the past, however this has less applicability to climate change and establishes a higher bar for fair application. The exemption to protect life or health is more consistent with coercive trade policies and considerations of humanitarian interests. Fundamentally, GHG emissions do not follow borders. Sovereign countries are affected by their trading partners' emissions and are entitled to mitigate climate risk on the basis of their exports.

The United Nations Framework Convention on Climate Change (UNFCCC) is the parent treaty of the 2015 Paris Agreement and covers a network of UN climate institutions that has existed for far longer.[87] It is independent from the Intergovernmental Panel on Climate Change (IPCC), which issues regular reports that summarize climate science and impacts.[88] The UNFCCC secretariate is an umbrella institution for international climate action, managing the 2001 adaptation fund, the Kyoto Protocol Conference of the Parties, and the new Loss & Damage Fund, formed in 2023. It overseas the conference of the Parties (COP), the annual multilateral convention on climate with near universal governmental representation. Subsidiaries provide assistance regarding scientific, technical, and policy questions and issue regular reports that summarize the latest climate science and policy recommendations. The UNFCCC would constitute the most obvious institutional infrastructure for any climate trade control regime and carry the legitimacy of the U.N. However, there may be advantages in leveraging smaller, independent trade control institutions to address climate threats than merely expanding the UNFCCC network with its already enormous scope. They wield expertise in nonproliferation and trade controls, credibility with stakeholders, and orthogonal security interests that the UNFCCC and its subsidiaries do not. An important first step for strategic trade management stakeholders is to begin participating in UNFCCC activities and building institutional bridges.

While a stretch given its historic behavior, the Wassenaar Arrangement is the least inappropriate of the four exiting control regimes to take up the question of fossil fuels, deforestation, and related goods and technologies, because fossil fuels are more analogous to dual use materials than weapons.[89] While wielding little binding authority and relying on consensus, Wassenaar has the power to solidify new norms in the strategic trade management community that climate change is a security and proliferation threat and that goods such as fossil fuels are dual-use items, subject to control on the basis of climate mitigation.

A new control regime, potentially based on a new fossil fuel nonproliferation treaty, would establish a strong foundation for multilateral controls and unburden first movers with the costs of inventing new bureaucracies.[90] The Fossil Fuel Treaty Initiative has collected endorsements for such a treaty from 6 nations, 89 subnational governments, the World Health Organization,

87 "What Are Governing, Process, Management, Subsidiary, Constituted and Concluded Bodies?" UNFCCC, <https://unfccc.int/process-and-meetings/what-are-governing-process-management-subsidiary-constituted-and-concluded-bodies>.

88 All IPCC reports are available at <https://www.ipcc.ch/>.

89 The Wassenaar Arrangement, <https://www.wassenaar.org/>.

90 Peter Newell, Andrew Simms, "Towards a Fossil Fuel Nonproliferation Treaty," *Climate Policy*, Vol. 20 (2020), pp. 1043-1054, <https://www.tandfonline.com/doi/full/10.1080/14693062.2019.1636759>.

and the European Parliament, and they curate an online library of scholarship on these topics.[91]

The Organization of the Petroleum Exporting Countries (OPEC) is an intriguing organization in this space, because it has vast, multilateral power to control oil exports. One of its primary purposes is to limit exports to maintain sufficiently high international prices. Attempting to portray an image of climate consciousness and concern, OPEC has the ability to discriminate on the basis of relative end-user climate impact. Unfortunately, despite all OPEC countries having signed on to the Paris Agreement, OPEC is fundamentally opposed to the goal of phasing out fossil fuels. Its members are too reliant on oil export revenue. While obviously opposed to phase outs of their economic livelihood, there is recent evidence that international pressure and moral authority can overcome their intransigence, reminiscent of 20th century nonproliferation history. Until 2023, OPEC countries have consistently blocked statements by the international climate conference, the annual Conference of the Parties (COP), that specifically called for the phase out of fossil fuels.[92] That trend ended in December 2023 at COP28, with the first supermajority-approved statement calling for the phase out of fossil fuels.[93] Afterward, UN Secretary General Guterres addressed the OPEC opponents, saying that "fossil fuel phase out is inevitable whether they like it or not. Let's hope it doesn't come too late."[94] OPEC can choose to be the final holdouts and suffer the consequences, or it can leverage its institutional power to control the phase out. OPEC can choose to continue to deal its addictive fuel long past its time of legitimacy or it can be the world's methadone prescriber as it breaks its own addiction to this damaging source of income.

3.4 Case Study: The United States

The United States is an important example given its old and complex trade control architecture, its market power, and its role as one of the worst climate offenders. It is the world's biggest producer of oil and natural gas.[95] While a net exporter, the vast majority of these fossil fuels are consumed domestically, resulting in some of the world's highest per capita emissions. There is little political momentum for a national price on carbon in the United States, so perhaps modest progress can be made in export control policy.

Exports of oil, coal, and natural gas are already banned by the energy Policy and Conservation Act of 1975, authorizing the executive branch to grant export licenses on the basis of "national interest."[96] Crude oil licenses are reviewed by the U.S. Department of Commerce, Bureau of Industry and Security (BIS) under the presumption of denial, however refined petroleum

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91 Fossil Fuel Treaty Initiative, <https://fossilfueltreaty.org/endorsements/>.

92 "Why Does OPEC Oppose the Idea of a Fossil Fuel Phase-Out at COP28?" *Reuters*, December 12, 2023.

93 "COP28 Ends with Call to 'Transition Away' from Fossil Fuels; UN Chief Says Phaseout is Inevitable," United Nations Development Group, December 13, 2023, <https://unsdg.un.org/latest/stories/cop28-ends-call-%E2%80%98transition-away%E2%80%99-fossil-fuels-un-chief-says-phaseout-inevitable>.

94 lbid

95 U.S. Energy Information Administration, "International," <https://www.eia.gov/international/>.

96 Adam Vann, Daniel T. Shedd, Brandon J. Murrill, "Federal Permitting and Oversight of Export of Fossil Fuels," Congressional Research Service, September 17, 2013, <https://sgp.fas.org/crs/misc/R43231.pdf>.

products are exempt.[97] As a result, the U.S. imports significant quantities of crude oil simply to be refined and re-exported.[98,99] Despite this presumption of denial, the U.S. has approved and increased crude oil exports over the past 5 years to 3.58 million barrels per day in 2022.[100] The executive branch does not appear to have exercised its power to restrict coal exports.[101] Most U.S. coal and oil exports are shipped to Europe and Asia.[102]

Export licenses for natural gas are based on the Natural Gas Act of 1938, which similarly approves restrictions based on the "public" interest.[103,104] However, amendments have later determined that natural gas exports to free-trade agreement countries must be approved.[105,106] Licenses are issued by the Department of Energy (DOE)'s Office of Fossil Energy and Carbon Management with records consistent with a permissive approval posture.[107]

It appears that no new statutory authorities would be required for U.S. agencies to restrict fossil fuel exports on the basis of a climate framework like the one outlined previously with the exception of natural gas exports to free trade countries. Climate change is in the "public interest" and "national interest," and the restrictions would also be consistent with WTO General Exemption to "protect human, animal or plant life or health" in GATT Article XX. Congress has considered several bills that would require such considerations in export licensing decisions, most often sponsored by Senator Ed Markey.

In fact, modest moves in this direction have recently been made. In January 2024, the Biden Administration paused the approval of new, long-term investments in natural gas exports.[108]

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97 Ibid.

98 U.S. Energy Information Administration, "Oil and Petroleum Products Explained," Updated October 2, 2023, <https://www.eia.gov/energyexplained/oil-and-petroleum-products/imports-and-exports.php>.

99 U.S. Energy Information Administration, "Petroleum & Other Liquids," Released September 29, 2023, <https://www.eia.gov/dnav/pet/pet_move_exp_dc_NUS-Z00_mbblpd_a.htm>.

100 Ibid.

101 Adam Vann, Daniel T. Shedd, Brandon J. Murrill, "Federal Permitting and Oversight of Export of Fossil Fuels," Congressional Research Service, September 17, 2013, <https://sgp.fas.org/crs/misc/R43231.pdf>.

102 U.S. Energy Information Administration, "Oil and Petroleum Products Explained," Updated October 2, 2023, <https://www.eia.gov/energyexplained/oil-and-petroleum-products/imports-and-exports.php>.

103 Adam Vann, Daniel T. Shedd, Brandon J. Murrill, "Federal Permitting and Oversight of Export of Fossil Fuels," Congressional Research Service, September 17, 2013, <https://sgp.fas.org/crs/misc/R43231.pdf>.

104 U.S. Natural Gas Act of 1938, <https://www.energy.gov/sites/prod/files/2013/04/f0/2011usc15.pdf>.

105 Adam Vann, Daniel T. Shedd, Brandon J. Murrill, "Federal Permitting and Oversight of Export of Fossil Fuels," Congressional Research Service, September 17, 2013, <https://sgp.fas.org/crs/misc/R43231.pdf>.

106 15 U.S. Code § 717b, "Exportation or Importation of Natural Gas; LNG Terminals," <https://www.law.cornell.edu/uscode/text/15/717b>.

107 U.S. Department of Energy Office of Fossil Energy and Carbon Management, "Electronic Docket Room (e-Docket Room)," Updated January 1, 2022, <https://www.energy.gov/fecm/articles/electronic-docket-room-e-docket-room>.

108 Timothy Gardner, "Biden Pauses LNG Export Approvals After Pressure From Climate Activists," *Reuters*, January 26, 2024, <https://www.reuters.com/business/energy/biden-pauses-approval-new-lng-export-projects-win-climate-activists-2024-01-26/>.

This is consistent with the use of natural gas as a short-term stopgap to replace coal and help international partners transition from fossil fuels but also as a fossil fuel that is not a long-term solution to reducing emissions.

Part 4: Demand-Side Policies: Carbon Pricing Schemes (CPS) and Carbon Border Adjustments (CBA)

A Carbon Pricing Scheme (CPS) is a domestic policy that raises prices on fossil fuels and derivative products or other sources of GHG emissions to reduce demand, consumption, and therefore GHG emissions. Among climate activists and policy wonks, it is generally the tip of the spear of any climate solution, which enables the free market to innovate and transition toward low-carbon energy alternatives far beyond the scale or efficiency of any government subsidy. A less well-known policy is a Carbon Border Adjustment (CBA), a tariff that countries with a CPS impose on imports not based on their value but on the basis of their carbon intensity. The purpose of a CBA is to level the playing field for domestic products, which were subject to a domestic CPS during production, and imports, which were not. Such policies are known by a wide variety of names but will be referred to respectively as "CPS" and "CBA" in this article to avoid confusion.

A robust academic, economic, and legal debate has emerged around the compatibility of various CPS and CBA policies with World Trade Organization (WTO) rules and norms, many of which constitute uncharted territory.[109,110,111,112] Rules that govern border adjustment taxes, value added taxes, and subsidies are meant to secure free enterprise in international trade and most-favored nation status. These are economic concerns which are inherently at odds with policies to restrict trade for the purposes of orthogonal goals like security or climate change. If governed only by economic precedence, CPS and CBA policies will be limited in their ability to mitigate climate change.

Therefore, given the scale and urgency of today's climate crisis, it is important to bypass such economic assumptions in favor of the WTO General Agreement on Tariffs and Trade (GATT) Article XX General Exemption "to protect human, animal, or plant life or health."[113] If a CPS/CBA policy reasonably advances climate mitigation or its future prospects, this general

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109 Christoph Böhringer, Carolyn Fischer, Knut Einar Rosendahl, Thomas Fox Rutherford, "Potential Impacts and Challenges of Border Carbon Adjustments," *Nature Climate Change*, Vol. 12 (2022), pp. 22–29, <https://www.nature.com/articles/s41558-021-01250-z>.

110 Sean Gordon, "The Great Green Wall: Understanding Policy Options for Carbon Border Adjustments," *Policy Perspectives*, Vol. 30 (2023), <https://journal.policy-perspectives.org/articles/volume_30/10_4079_pp_v30i0_04.html>.

111 Joachim Englisch, Tatiana Falcao, "EU Carbon Border Adjustments for Imported Products and WTO Law," SSRN (2021) <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3863038>.

112 Giulia Claudia Leonelli, "Export Rebates and the EU Carbon Border Adjustment Mechanism: WTO Law and Environmental Objections," *Journal of World Trade*, Vol. 46, pp. 963-984, <https://kluwerlawonline.com/journalarticle/Journal+of+World+Trade/56.9/TRAD2022040>.

113 World Trade Organization, General Agreement on Tariffs and Trade (GATT), Article XX, "General Exemptions," <https://www.wto.org/english/res_e/booksp_e/gatt_ai_e/art20_e.pdf>.

exemption should supersede juris prudence on the economic regulation of trade. This requires shifting norms that delegitimize fossil fuels as benign products of unrestricted trade. Such norms can be advanced by the framing of climate change as a proliferation threat, discussed in Part 2, and by the imposition of strategic trade controls, discussed in Part 3.

Article XX is not an excuse for unfair trading practices. For example, a CBA on an import must deduct costs already paid via a CPS in the exporting country.[114] Also, a CBA can level the playing field, but it cannot impose higher restrictions on carbon than a country imposes domestically via its CPS.[115] Therefore, CPS and CBA policies are tightly linked, not just domestically but across trading partnerships, and neither can be designed or enforced without a robust understanding of the other. For that reason, Part 4 will first provide an introductory overview of domestic CPS policies before addressing CBA policies. CPS policies of both the importer and the exporter are the foundation and guiderails for any CBA.

4.1 Designing a Domestic Carbon Pricing Scheme (CPS)

The goal of a CPS is to price the externalized costs of climate change into the market price of fossil fuels and derivative products. Unlike a ban, quota, or emissions standard, the transition is gradual. Higher prices reduce demand and shift supply chains from fossil fuels to alternatives, incentivizing long-term research and other investments in alternative technologies, and unleashing private finance. Many CPS policies have been enacted and proposed around the world, and they tend to vary in how they answer the following four questions:

4.1.1 Set a Price on Carbon or Cap Emissions and Let Markets Set the Price?

A CPS usually falls into one of two categories: A "carbon tax" is a government-set tax on fossil fuels or other activities that produce greenhouse gas (GHG) emissions. Even a modest carbon tax has been shown to reduce total emissions, but there is no theoretical cap on total emissions.[116] Emissions will continue as long as consumers are willing to pay the price. Conversely, in a "cap & trade," or "emissions trading" system, the government caps total emissions from covered sectors and issues allowances to produce emissions (e.g., emissions credits) to the private sector, often by annual auction. Those emissions credits can then be bought and sold by private entities, so the effective price on GHG emissions is market-driven. In theory, a carbon tax sets a more predictable price, but results in less predictable total emissions and economic disruption than emissions trading schemes.

In practice, however, carbon taxes start low, causing minimal disruption, and the market gradually adapts. In comparison, emissions trading schemes have suffered from price volatility, administrative complexity, technical enforcement challenges, and limited sectoral scope that

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114 Joachim Englisch, Tatiana Falcao, "EU Carbon Border Adjustments for Imported Products and WTO Law," SSRN (2021) <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3863038>.

115 Ibid.

116 Charles Komanoff, "Australia's Brief, Shining Carbon Tax," Carbon Tax Center, January 7, 2020, <https://www.carbontax.org/blog/2020/01/07/australias-brief-shining-carbon-tax/>.

incentivizes the reshuffling of emissions to uncovered sectors. Emissions trading systems are also much more difficult and complex than carbon taxes to enforce at the border via a CBA. The price is constantly changing, and it is not clear how imports would be considered in the total supply of emissions credits. A carbon tax is generally preferred by American conservatives, at least those who accept the reality of the climate threat, and fossil fuel industries to an emissions trading system.[117]

The World Bank maintains a dashboard of CPS policies including 73 implemented initiatives, 39 national programs, and the EU Emissions Trading System (Figure 4).[118] The European Union (EU) has one of the oldest CPS policies, having instituted its Emissions Trading System in 2005 after the Kyoto Treaty, which called for cap & trade systems.[119] However, several EU countries implement additional CPS policies, such as carbon taxes. Much has been learned and adjusted across the EU's four phases of gradual implementation. Canada, Mexico, and Japan each have an emissions trading system and a carbon tax on fuels.[120] South Africa imposed a modest carbon tax in 2019.[121] Australia imposed a modest but effective carbon tax in 2012.[122] It was repealed by a new conservative government in 2014, and in July 2023, replaced with a new carbon tax on emissions above a certain threshold.[123] China enacted an emissions trading scheme in 2020, though like the early days of the EU's emissions trading scheme, a generous issuance of emissions credits has made the effective price on carbon negligible.[124] A trend that is rapidly catching on, dozens of other countries are considering CPS policies. The United States has no national CPS, though some states, most notably California, have enacted emissions trading systems. However, the effectiveness of state and municipality-based CPS policies is limited by the inability to enact a CBA on interstate commerce.

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117 The CEO of Exxon supported a revenue-neutral carbon tax, describing it as "a more direct, a more transparent, and a more effective approach" than cap & trade. See George P. Shultz, James A. Baker III, "A Conservative Answer to Climate Change," *Wall Street Journal*, February 7, 2017, <https://www.wsj.com/articles/a-conservative-answer-to-climate-change-1486512334>.

118 "Carbon Pricing Dashboard," World Bank, <https://carbonpricingdashboard.worldbank.org/>.

119 "Development of EU ETS (2005-2020)," European Commission, <https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/development-eu-ets-2005-2020_en>.

120 "Carbon Pricing Dashboard," World Bank, <https://carbonpricingdashboard.worldbank.org/>.

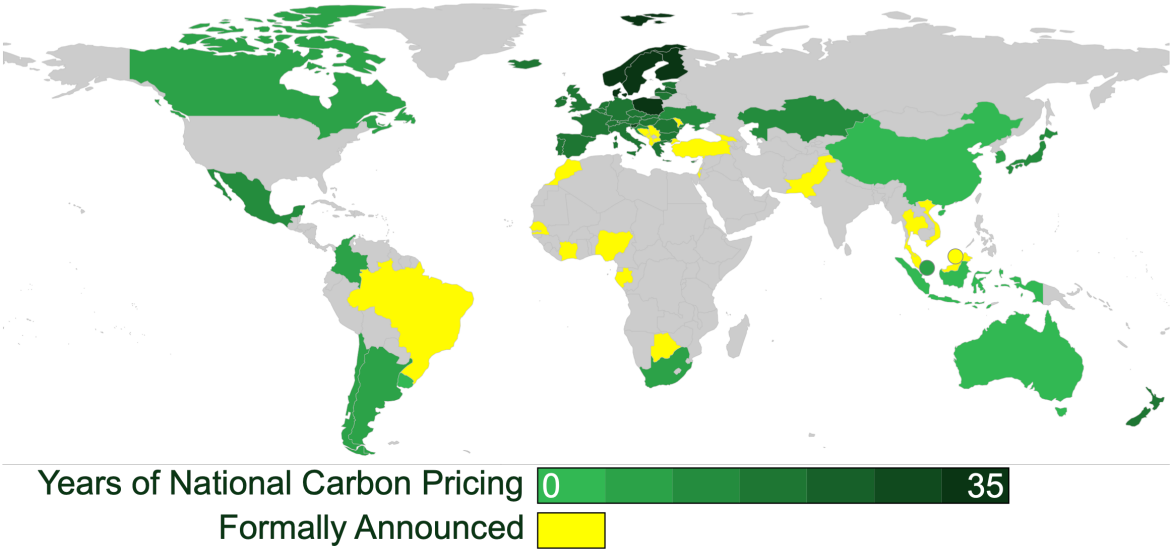
121 "South Africa Carbon Pricing and Climate Mitigation Policy," International Monetary Fund, African Department, June 6, 2023, <https://www.elibrary.imf.org/view/journals/002/2023/195/article-A003-en.xml#:~:text=The%20generous%20tax%2Dfree%20thresholds,about%20%248)%20by%20end%202022>.

122 Charles Komanoff, "Australia's Brief, Shining Carbon Tax," Carbon Tax Center, January 7, 2020, <https://www.carbontax.org/blog/2020/01/07/australias-brief-shining-carbon-tax/>.

123 "Australia Makes Biggest Carbon Polluters Curb Emissions," *Associated Press*, March 30, 2023.

124 "China's Emissions Trading Scheme," Country Report, International Energy Agency, June 2020, <https://www.iea.org/reports/chinas-emissions-trading-scheme>.

Figure 4. National CPS Policies[125]



4.1.2 Where in the Supply Chain Should Carbon Be Priced, and Who Should Be Exempt?

Carbon prices applied early in the supply chain, such as taxes on fossil fuel extraction or refinement, are relatively simple to administer and very difficult for producers to evade. The higher prices are efficiently distributed throughout the supply chain. The United States, while not employing a national CPS, already enforces a tax on coal extraction to fund the Black Lung Disability Trust Fund.[126] It previously taxed crude oil extraction to support the Oil Spill Liability Trust Fund.[127] If prices are assessed later in the supply chain, administrative complexity, cost, and risk of evasion becomes exponentially higher. In theory, a price applied later in the supply chain could better consider the nuances of how fossil fuels are used, like methane and NO_x emissions. However, other regulations or excise taxes could do so without burdening the CPS administration, such as emissions standards requiring catalytic converters or other environmental protection laws.

There are two reasons why many countries may choose to apply a CPS late in the supply chain, despite its inherent inefficiencies: The first is political opportunities for industrial policy. Many CPS policies exempt certain emissions sources due to the practicality of enforcement or their strategic, economic, or political value. The EU CPS only covers 41% of emissions, exempting the majority of emissions entirely.[128] While South Africa's carbon tax was set about USD $7

125 "Carbon Pricing Dashboard," World Bank, <https://carbonpricingdashboard.worldbank.org/>."

126 "The Black Lung Program, the Black Lung Disability Trust Fund, and the Excise Tax on Coal," Congressional Research Service, February 7, 2023, <https://crsreports.congress.gov/product/pdf/R/R45261>.

127 "Oil Spill Liability Trust Fund," U.S. Environmental Protection Agency, Updated December 20, 2022, <https://www.epa.gov/oil-spills-prevention-and-preparedness-regulations/oil-spill-liability-trust-fund#:~:text=The%20Fund%20is%20administered%20by,connection%20with%20any%20single%20incident>.

128 "Increasing the Ambition of EU Emissions Trading," European Commission, <https://climate.ec.europa.eu/eu-action/increasing-ambition-eu-emissions-trading_en>.

per ton of CO_2e, the effective rate due to thresholds and allowances was USD $0.36 per ton of CO_2e.[129] Exemptions significantly diminish the climate impact of a CPS, and can enable policy makers to pretend that their CPS policy is more effective than it is. They can even cause a CPS to do more harm than good by reshuffling emissions to distributed sectors that lose efficiencies of scale. This risk of carbon leakage only increases with increased pressure from carbon prices, which need to rise significantly and rapidly to effectively curb global emissions.

The second reason that countries may choose to apply a CPS late in the supply chain is to avoid the need for a CBA. The earlier the tax is applied in the supply chain, and therefore the more distributed the rise in prices, the more vulnerable domestic products are to being outcompeted by imports that were not subject to a CPS. A CPS applied later in the supply chain is fed by both domestic and imported raw materials. A fuel tax is a good example, where gasoline can be taxed at the pump, regardless of its origin, instead of at the point of refinement and importation at the border. However, most supply chains are too complex for this assessment. Even in the case of gasoline, higher transportation costs have downstream effects. A robust CBA would allow countries to apply a CPS earlier in the supply chain without being undercut by cheaper imports. A CBA enables a far simpler, more efficient, fairer, and more comprehensive domestic CPS.

4.1.3 How Should Carbon Be Priced?

Making a CPS more aggressive means raising the carbon tax or reducing the supply of emissions credits. For the first few years, the price should be marginal as new institutions and enforcement practices are established and the private sector becomes familiar with the CPS. Then, prices are increased by raising the carbon tax or reducing the supply of emissions credits, as was done in the EU, to shift supply chains away from fossil fuels. (Figure 5) Regulators may regularly adjust carbon taxes and the issuing of emissions credits based on emissions and economic data to achieve desired emissions targets or mitigate economic harms.

129 "South Africa Carbon Pricing and Climate Mitigation Policy," International Monetary Fund, African Department, June 6, 2023, <https://www.elibrary.imf.org/view/journals/002/2023/195/article-A003-en.xml#:~:text=The%20generous%20tax%2Dfree%20thresholds,about%20%248)%20by%20end%202022>.

Figure 5. EU Emissions Trading System Prices[130]



The social cost of carbon (SCC), discussed in Part 1 of this article, is a valuable policy benchmark for a CPS. In theory, a CPS that is lower than the SCC is insufficient, externalizing climate costs to the world. A CPS that is equivalent to the SCC is theoretically financially sustainable, inflicting environmental costs that users are willing to pay for. However, a price higher than the SCC is warranted to speed the transition, meet the Paris Agreement's goal of limiting warming to 1.5 ºC, and protect future generations. Enough fossil fuel sources have already been developed to push the world over the 1.5 ºC goal, so a CPS would have to be sufficiently cost prohibitive to leave some of those fossil fuels unburned.[131] Most CPS policies are still in the early stages of applying marginal carbon prices, but some EU countries with carbon taxes in addition to the EU Emissions Trading System and Uruguay's fuel tax come close to a plausible SCC, though only for limited sectors of the economy.[132]

4.1.4 What Should Governments Do with CPS Revenue?

Canada returns the revenue from its fuel tax directly to its citizens in the form of quarterly

130 Figure 5 is republished from Trading Economics, "EU Carbon Permits," February 6, 2024, <https://tradingeconomics.com/commodity/carbon>.

131 Dan Welsby, James Price, Steve Pye, Paul Ekins, "Unextractable Fossil Fuels in a 1.5 °C World," *Nature*, Vol. 597 (2021), pp. 230–234, <https://www.nature.com/articles/s41586-021-03821-8>.

132 "Carbon Pricing Dashboard," World Bank, <https://carbonpricingdashboard.worldbank.org/>.

"Climate Action Incentive Payments".[133] This often-studied "carbon tax & dividend" policy is what the Wall Street Journal called "A Conservative Answer to Climate Change" and is also advocated for by the Citizens Climate Lobby and Climate Leadership Council.[134,135,136] Revenue that is returned in full to citizens makes up for increases in prices due to the carbon tax and rewards consumer behavior away from fossil fuels. A CPS that directly subsidizes consumers has obvious political advantages as well as administrative simplicity. It also has cross-cutting economic appeal, piloting a form of universal basic income.

The EU returns ETS revenue to Member States, requiring that at least 50% goes toward climate and energy related projects.[137] In 2021, 76% of ETS revenue was applied to this goal.[138] Since 2008, Switzerland has returned 2/3 of its carbon tax revenue to its residents and the remaining to a clean technology fund.[139] The need for rapid investment in green energy and climate adaptation makes this application popular, however it exposes consumers to higher prices without direct compensation.

An inherent problem of a national CPS is that the costs of climate change are not merely born by the residents of the emitting country, but by the world. The developing world is most vulnerable to climate change while emitting less GHG per capita. As discussed in section 3.1.7, the UN principle of "differentiated responsibility" obligates rich countries to contribute funding to the energy transition of developing economies. They have committed to USD $100 billion per year to support climate action in developing countries, but this promise has not been met.[140] A new Loss & Damage fund was established in 2023 at COP27 but has not yet received contributions.[141] A just and equitable use of CPS revenue would include significant contributions to such funds. Financial assistance is needed to "leapfrog" fossil fuel intensive

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133 "Climate Action Incentive Payment," RC4215(E), Government of Canada, Revised July 2023, <https://www.canada.ca/en/revenue-agency/services/forms-publications/publications/rc4215/climate-action-incentive-payment.html>.

134 George P. Shultz, James A. Baker III, "A Conservative Answer to Climate Change," *Wall Street Journal*, February 7, 2017, <https://www.wsj.com/articles/a-conservative-answer-to-climate-change-1486512334>.

135 "REMI Report: The Environmental, Economic and Health Impact of Carbon Fee and Dividend," Citizens' Climate Lobby, <https://citizensclimatelobby.org/remi-report/>.

136 "The Four Pillars of the Carbon Dividends Plan," Climate Leadership Council, <https://clcouncil.org/four-pillars/>.

137 "Development of EU ETS (2005-2020)," European Commission, <https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/development-eu-ets-2005-2020_en>.

138 "Use of Auctioning Revenues Generated Under the EU Emissions Trading System," European Environment Agency, February 3, 2023, <https://www.eea.europa.eu/ims/use-of-auctioning-revenues-generated>.

139 "Redistribution of the CO2 Levy," Swiss Federal Council Federal Office for the Environment, Modified September 13, 2023, <https://www.bafu.admin.ch/bafu/en/home/topics/climate/info-specialists/reduction-measures/co2-levy/redistribution.html>.

140 "Adaptation Gap Report 2022," UN Environment Programme, November 1, 2022, <https://www.unep.org/resources/adaptation-gap-report-2022>.

141 "COP27 Reaches Breakthrough Agreement on New 'Loss and Damage' Fund for Vulnerable Countries," UNFCCC, November 20, 2022, <https://unfccc.int/news/cop27-reaches-breakthrough-agreement-on-new-loss-and-damage-fund-for-vulnerable-countries>.

development in favor of green energy.[142] It is also needed to help developing economies to establish their own CPS infrastructure and supply-side fossil fuel policies. Favorable trade terms and direct capacity building programs, discussed in section 5.1, have the added benefit of advancing multilateralism and aligning economic and trade policies.

Other proposals for the use of CPS revenue include payments to owners of fossil fuel mining rights in exchange for commitments not to extract fossil fuels, like a climate easement.[143] However, it is difficult to see the owners of mining rights as the chief victims of climate change, warranting compensation. However, it may be a necessary model for reaching international consensus. Fossil fuel producing countries can be persuaded to leave fossil fuels in the ground in exchange for financial assistance.

4.2 Carbon Border Adjustments (CBA)

Customs authorities do not set domestic CPS policy but any effective CPS eventually needs to be enforced at the border to protect domestic competition and prevent reshuffling. With fossil fuels permeating every aspect of the global economy, this can be a daunting task. Until the recent EU CBA, no country has implemented a broad CBA policy to protect their domestic economy. They have instead designed their CPS policy around this omission, accepting economic costs, administrative burdens, and carbon leakage. A robust literature has recently emerged about CBA policies and the uncharted waters of WTO compatibility.[144,145,146,147]

The remainder of Part 4 of this article will discuss effective design and customs enforcement of a CBA:

- Makes an effective domestic CPS possible
- Generates revenue without the retaliatory downsides of traditional tariffs
- Pushes trading partners toward their own CPS policy, driving multilateral climate action

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142 Kyle S. Herman, "Green Growth and Innovation in the Global South: A Systematic Literature Review," *Innovation and Development*, Vol. 13 (2021), pp. 43–69, <https://doi.org/10.1080/2157930x.2021.1909821>.

143 Lorenzo Pellegrini, Murat Arsel, Marti Orta-Martinez, Carlos F. Mena, Gorka Muñoa, "Institutional Mechanisms to Keep Unburnable Fossil Fuel Reserves in the Soil," *Energy Policy,* Vol. 149 (2021), <https://www.sciencedirect.com/science/article/pii/S0301421520307400>.

144 Christoph Böhringer, Carolyn Fischer, Knut Einar Rosendahl, Thomas Fox Rutherford, "Potential Impacts and Challenges of Border Carbon Adjustments," Nature Climate Change, Vol. 12 (2022), pp. 22–29, <https://www.nature.com/articles/s41558-021-01250-z>.

145 Sean Gordon, "The Great Green Wall: Understanding Policy Options for Carbon Border Adjustments," Policy Perspectives, Vol. 30 (2023), <https://journal.policy-perspectives.org/articles/volume_30/10_4079_pp_v30i0_04.html>.

146 Joachim Englisch, Tatiana Falcao, "EU Carbon Border Adjustments for Imported Products and WTO Law," SSRN (2021) <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3863038>.

147 Giulia Claudia Leonelli, "Export Rebates and the EU Carbon Border Adjustment Mechanism: WTO Law and Environmental Objections," Journal of World Trade, Vol. 46, pp. 963-984, <https://kluwerlawonline.com/journalarticle/Journal+of+World+Trade/56.9/TRAD2022040>.

Domestic products that are subject to a CPS need to be protected from competition with cheaper imports, which were subjected to smaller or nonexistent CPS policies. The solution to this "freeloader problem" is a Carbon Border Adjustment (CBA), which assesses a tariff on all imports based on the carbon price that would have hypothetically been assessed if the product had been produced domestically. Figures 6 and 7 show a basic outline of how a CBA would be applied to imports and exports to level the playing field for domestic competition.

Figure 6. A CBA ensures that imports from a non-CPS country compete fairly with domestic products. A CPS country may decide not to issue CPS rebates if the higher prices are still competitive in foreign markets.

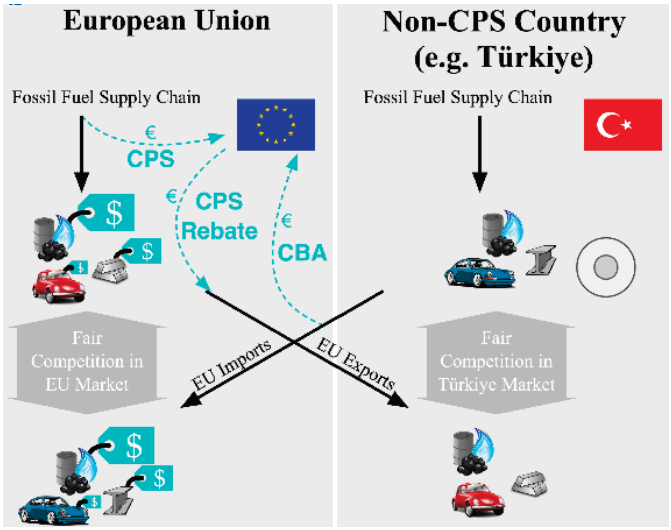
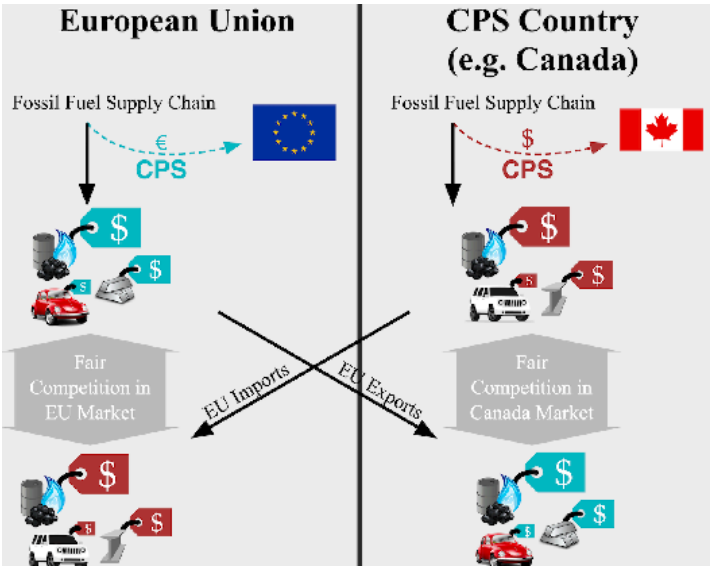


Figure 7. No CBA is allowed when trading with a country that has the same level of carbon pricing. Canada's CPS is not equivalent to the EU CPS but is used here as a notional example of what would happen if it was equivalent.



Today, many CPS economies simply accept the costs of not implementing a CBA. This cost can be minimal because carbon prices are initially modest or highly exempted. However, as

carbon prices increase in size and scope, a CBA becomes increasingly important to protect both the domestic economy and the effectiveness of the policy in mitigating GHG emissions. Pricing emissions later in the supply chain has the advantage of functioning as a CBA on imports of raw materials. However, as discussed previously, carbon prices early in the supply chain are far more efficient and effective.

The EU, with one of the oldest and most aggressively priced CPS policies, is the first economy to implement a broad CBA, called a "Carbon Border Adjustment Mechanism."[148] This policy was first piloted in 2023 and will come into full affect in 2026. The EU's significant role in international trade and the size and maturity of its emissions trading system makes this a significant change to the landscape of international trade and climate policy.

The existence of a CBA in international trade not only reflects a maturation of CPS policies, it constitutes a new vector for competition in international trade. Its precise policy structure and enforcement practices can make the difference between rewarding countries with robust CPS policies and advancing climate mitigation worldwide. Conversely, a compromising or tenuous CBA would enable freeloaders and carbon leakage at the implementing country's expense.

To protect the competitiveness of exports from CPS-enforcing to non-CPS countries, CPS rebates may be issued to exporters. However, this is a subject of debate.[149,150] Canada already does this, providing fuel tax rebates to exporters of fuels that have already been subject to the fuel tax. However, such rebates result in carbon leakage, with producers favoring foreign markets with lower carbon pricing. Rebates may compromise WTO compliance if considered a "subsidy," though there are legitimate means by which countries can forgo taxes without this restriction.[151] Skipping the rebate would allow the country to retain that revenue, while higher prices are paid by foreign consumers.

4.3 First-Mover Advantage: Establishing a Virtuous Imbalance with a CBA That Rewards Climate Action

Conventional wisdom would suggest that, from a global perspective, the pricing of carbon emissions is an economic no-brainer to avert the costs of climate change, but that any country who does so on their own bears a disproportionate economic burden. This "collective action problem" or "tragedy of the commons" conventional wisdom is one of the most significant political barriers to action. However, a CBA is a tool that allows first-mover, carbon-restrictive economies to reap economic *rewards* in international markets. This could be a political game changer for climate action.

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148 "Carbon Border Adjustment Mechanism," European Commission Taxation and Customs Union, <https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en>.

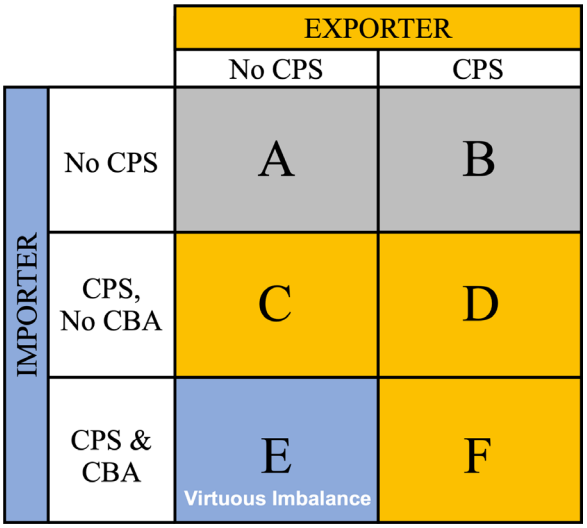
149 Joachim Englisch, Tatiana Falcao, "EU Carbon Border Adjustments for Imported Products and WTO Law," SSRN (2021) <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3863038>.

150 Giulia Claudia Leonelli, "Export Rebates and the EU Carbon Border Adjustment Mechanism: WTO Law and Environmental Objections," Journal of World Trade, Vol. 46, pp. 963-984, <https://kluwerlawonline.com/journalarticle/Journal+of+World+Trade/56.9/TRAD2022040>.

151 Ibid.

Consider a thought experiment in which trading partners either do or do not have a CPS and do or do not have a CBA (Figure 8). While a CPS can take many forms and scales, assume for this purpose that all CPS policies would be equivalent. To the extent that CPS policies are not equivalent or aligned, the lower or more exempt CPS policy would be the equivalent of a "no CPS" scenario in Figures 6 and 8. Various combinations of trading partners with different CPS and CBA policies either rewards progressive climate policies or they reward freeloaders engaging in unrestricted fossil fuel use.[152]

Figure 8. Revenue imbalances in trade: grey, no inherent net balance; yellow, advantage to the exporter; blue, advantage to the importer



There are two scenarios that reward polluters: The first is a common status quo (Figure 8A), where neither trading partner has a CPS and climate costs are externalized. The second is where one trading partner has no CPS and the other has a CPS but no CBA (Figure 8C). The trading partner without a CPS will have a competitive advantage in the CPS market and undercut the CPS economy. This is the status quo for the dozens of economies with CPS policies and no CBA, including U.S. states like California that cannot impose border adjustments on interstate commerce. The freeloader is rewarded at the expense of the CPS economy.

In the best-case, long-term, blue-sky scenario, trading partners have a similar, aligned CPS policy (Figure 7, Figure 8D, F). No CBA is necessary or even allowed by WTO rules. Both may benefit from bypassing the burdensome practice of assessing a CBA, constituting an efficient and sustainable trading system. It would rely on multilateral alignment of CPS policies akin to the current multilateral control regimes, a new fossil fuel nonproliferation treaty, or perhaps a WTO-governed process. There would still be an importer/exporter imbalance, as the exporter collects CPS revenue while the importer's market is exposed to higher prices. However, these differences would cancel out if trade balances are small. Alternatively, the same multilateral

152 Emily Benson, "The OECD and Carbon Life-Cycle Assessments," Center for Strategic and International Studies (CSIS), October 22, 2021, <https://www.csis.org/analysis/oecd-and-carbon-life-cycle-assessments>.

alignment of CPS/CBA policies that enables this scenario could negotiate revenue sharing.[153] By leaving the CBA analytical infrastructure in place, the CPS revenue associated with a specific export could be transferred to the importing country to compensate for higher prices.

Advancing such a future, a virtuous imbalance scenario is generated between unaligned trading partners. It features one trading partner with a CPS and CBA, and the other with a lower or nonexistent CPS (Figure 6, Figure 8E/B). The CPS/CBA importer gains CBA revenue that the non-CPS exporter forwent.[154] To think of it another way, the importer with a CBA is effectively collecting a carbon tax on a foreign economy without imposing a competitive disadvantage on their products. Competition between imports and domestic products is fair, and reshuffling is minimized. Noticing this lost revenue opportunity, the non-CPS freeloading country will be incentivized to impose its own comparable or even more aggressive CPS policy. This could drive a virtuous competitive environment toward increasingly aggressive CPS/CBA climate policies, a political game changer. The mere existence of a CBA on the international stage creates a worldwide financial incentive for countries to compete for the highest carbon pricing.

The EU's 2026 CBA may be the first such domino to fall, compelling its trading partners to impose their own CPS to avoid losing revenue to the EU. A CBA offers an opportunity to overcome one of the most fundamental barriers to solving climate change – getting other countries to go along. Even if the entire EU never burned another kilogram of fossil fuel, it would constitute a less than 10% reduction in global emissions, so collective action is required.[155]

For example, in 2026 the U.S., which does not have a CPS, will directly lose money to the EU CBA until the U.S. establishes an equivalent, domestic CPS. If climate mitigation has not yet been sufficient motivation for the U.S. to enact a CPS, economic competition will soon raise the stakes. In fact, if the U.S. chooses to enact a higher or broader CPS than the EU, which should not be difficult, because the EU ETS only covers 41% of emissions, the U.S. can gain legitimate financial advantages from the EU and incentivize the EU to broaden its CPS in turn.

This competitive, virtuous cycle of climate competition is one of the most exciting features of a CBA. Unlike protectionist trade wars, these constitute legitimate, free-market policies that simply resolve a long-standing problem of externalized climate costs. They economically benefit those with the climate moral high ground and are consistent with existing international law and commitments. In considering a CBA, the Government of Canada describes this as a valuable feature, "BCAs can nudge other countries to implement stronger domestic climate policies to avoid subjecting their exported goods to the cost of a BCA and to maintain market

153 Aligns with the "destination principle" for value added taxes, where the importer is entitled to tax revenue, see <https://www.oxfordreference.com/display/10.1093/oi/authority.20110810104737666>.

154 The case of exports from a CPS trading partner to a non-CPS importer (Figure 8B) produces no net advantage and may vary based on whether or not a CPS rebate, discussed previously, is granted to exporters.

155 "EU's CO2 Footprint Continues to Decrease," Eurostat, May 24, 2022, <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220524-1>.

access."[156] Australia is also reviewing options for a CBA.[157]

How much revenue would be generated by a CBA? It is difficult to predict, because current carbon prices are generally modest or limited in scope. The EU CBA is projected to collect approximately USD $1.5 billion in annual revenue across all of its trading partners.[158] This is modest relative to the USD $33.6 billion in tariffs that the EU collected in 2022.[159] As prices approach the social cost of carbon and 100% coverage of emissions, EU CBA revenue is likely to approach the tens of billions of USD per year. However, unlike standard tariffs, exporting countries have a choice in the matter and a strong incentive to collect that revenue via a CPS before exporting products to the EU. Such a CPS is revenue neutral if returned to their population in some form.

Is this virtuous imbalance enough to drive unilateral CPS/CBA policies? It depends on the country and its specific trade circumstances. However, it is enough to simply shift the conversation from "Is the moral imperative and our children's future worth the short-term cost" to "Not only is it the right thing to do, we might financially benefit if we move fast."

If successful, the use of CPS/CBA pricing schemes to diminish fossil fuel demand and reach net neutrality by 2050 would eventually mean diminishment of CPS revenue as well. As fossil fuel consumption shrinks, any trade and revenue imbalances caused by CPS/CBA policies would also shrink. A successful, global movement to price carbon will put itself out of business, leaving supply-side, strategic trade controls discussed in part 3 of this article to prevent backsliding in the long term.

4.4 Leveraging the Virtuous Imbalance

The virtuous imbalance of a CBA has been criticized for potentially resulting in a transfer of wealth from developing economies without CPS policies to developed economies with a CPS and CBA.[160] However, it is not safe to assume that CPS/CBA policies will only be implemented by the most developed economies. Developing economies are the most vulnerable to climate

156 "Exploring Border Carbon Adjustments for Canada," Government of Canada, Modified June 2, 2023, <https://www.canada.ca/en/department-finance/programs/consultations/2021/border-carbon-adjustments/exploring-border-carbon-adjustments-canada.html>.

157 Chris Bowen, "ANU Professor Engaged for 'Carbon Leakage' Review," Australia Ministry of Climate Change and Energy, September 6, 2023, <https://minister.dcceew.gov.au/bowen/media-releases/anu-professor-engaged-carbon-leakage-review>.

158 "EU Carbon Border Adjustment Mechanism to Raise $80B per year by 2040," S&P Global, February 24, 2023, <https://www.spglobal.com/esg/insights/featured/special-editorial/eu-carbon-border-adjustment-mechanism-to-raise-80b-per-year-by-2040>.

159 "Customs Duties Mean Revenue," European Commission Taxation and Customs Union, <https://taxation-customs.ec.europa.eu/customs-4/eu-customs-union-facts-and-figures/customs-duties-mean-revenue_en>.

160 Christoph Böhringer, Carolyn Fischer, Knut Einar Rosendahl, Thomas Fox Rutherford, "Potential Impacts and Challenges of Border Carbon Adjustments" *Nature Climate Change*, Vol. 12 (2022), pp. 22–29, <https://www.nature.com/articles/s41558-021-01250-z>.

change, and they can reap rewards from implementing their own CBA.[161] Many might use the tool to compel the developed world to price carbon, while in the meantime, driving a transfer of wealth from developed to developing economies.

One of the biggest hurdles for many countries in implementing such policies are the technical demands of implementing a CPS/CBA, which first movers like the EU can catalyze. It is fortunate that the EU, with its size, influence, and history of foreign assistance is the first to implement a CBA. So, the prospects for multilateral cooperation are enhanced. Even the United States can provide such assistance for the purposes of advancing climate mitigation and sustainable development before making a commitment to a domestic CPS. Such capacity building programs and the details of implementation are discussed in Part 5.

Part 5: Customs Enforcement

5.1 Implementation Challenges and Capacity Building

Accurately and precisely determining most products' carbon intensity is impractically complex and data dependent. Referred to as "carbon lifecycle analysis" (LCA), it requires a tooth-to-tail analysis of all inputs and outputs for every product: feedstock carbon intensity, waste, energy inputs and composition, transportation, recycling, packaging, and even non-production inputs like R&D and administration. The Greenhouse Gas Protocol is the most widely employed methodology, complimented by a related protocol, ISO 14064.[162,163,164,165]

Given these administrative and analytical challenges, foreign capacity building will play an important role. As has occurred in the evolution of nonproliferation policies, large and relatively well-funded bureaucracies of developed economies can serve as a laboratory for best practices. It is in their interest to spread their enforcement methods to the rest of the world. They do so through specific training programs, like the U.S. Export Control and Related Border Security (EXBS) Program and the EU's Partner to Partner Export Control Program (EU P2P). They also do so by regularly sharing data, analysis, and control list updates with their partners.

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161 H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama, et al., "Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change," IPCC, 2022, Cambridge University Press, <https://www.ipcc.ch/report/ar6/wg2/>.

162 Greenhouse Gas Protocol, <https://ghgprotocol.org/>.

163 "Development of EU ETS (2005-2020)," European Commission, <https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/development-eu-ets-2005-2020_en>.

164 Emily Benson, "The OECD and Carbon Life-Cycle Assessments," Center for Strategic and International Studies (CSIS), October 22, 2021, <https://www.csis.org/analysis/oecd-and-carbon-life-cycle-assessments>.

165 "ISO 14064-1:2018," International Organization for Standardization, December 2018, <https://www.iso.org/standard/66453.html>.

In enforcing climate trade controls, assistance can include sharing emissions data, lifecycle analysis best practices, and CBA schedules with developing trading partners in the same way that shared control lists and enforcement best practices have long been shared in strategic trade management. Sharing these best practices constitutes a strategic advantage, building bargaining power as the chaos of competing, unaligned CPS and CBA policies will push the world toward multilateral controls. The first movers and the providers of assistance will set the terms for this future economy, while less-capable countries can gain administrative efficiencies from their experience. As the first mover in implementing a CBA, the EU has already committed to sharing best practices, data, analysis, and training materials.[166] In addition to reaping revenue as a first mover, they are likely to be standard setters for at least the next decade.

This is still a time of experimentation with CPS policies. As a result, many are far too complex to be exported in full, just as how the convoluted U.S. export control system is a poor policy model for export. After this time of experimentation, there is an opportunity to design a CPS/CBA policy-in-a-box that can be more parsimoniously deployed in developing countries. Such a model could feature a source-point carbon tax coupled with a CBA based on analysis performed by the EU. Alternatively, countries could simply join existing carbon markets, such as the EU Emissions Trading System, which has already been joined by non-EU countries Iceland, Liechtenstein, and Norway.[167] The analytical burdens of a CBA are a technical hurdle, but more developed and experienced governments can share data and analytical tools. Emily Benson identifies the same need and argues that the OECD may be the best forum for such sharing of standardized best practices.[168] See Section 3.3 for other institutional options.

New artificial intelligence and open-source data scraping tools may improve the efficiency and effectiveness of this step and lower administrative burdens.[169] With sufficient investment, there is an opportunity for an administrative and regulatory revolution in simplifying the implementation of a CPS/CBA policy. However, this is only a temporary solution in the absence of multilateralism. Markets and producers are most likely to respond when regulations and incentives are understandable by humans.

Despite the complexity of such policies, one of the biggest advantages of the fossil fuel nonproliferation framing of the climate problem is that strategic trade management, taxation, and tariff institutions, as well as vectors of multilateral cooperation, are already well established. No wheels need to be reinvented, merely new expertise and expectations.

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166 "Carbon Border Adjustment Mechanism," European Commission Taxation and Customs Union, <https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en>.

167 "Development of EU ETS (2005-2020)," European Commission, <https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/development-eu-ets-2005-2020_en>.

168 Emily Benson, "The OECD and Carbon Life-Cycle Assessments," Center for Strategic and International Studies (CSIS), October 22, 2021, <https://www.csis.org/analysis/oecd-and-carbon-life-cycle-assessments>.

169 "AI-Powered Carbon Border Adjustments," 2050, <https://2050.se/en/aica-ai-powered-carbon-border-adjustments-eng/>.

5.2 Leveraging Implementation Challenges: CBA Precision, Overestimation, Underestimation, and Burdens of Proof

The theory of calculating a CBA based on carbon intensity and deducting carbon pricing already paid becomes extremely challenging when CPS policies are not aligned among trading partners. Inputs and outputs need to be considered separately, because some may be considered or ignored based on the scope of a country's domestic CPS. How is a country with a fuel tax supposed to calculate a CBA on an import from a country with an emissions trading system on electricity? If the CBA is justified as a climate mitigation measure, aren't all emissions relevant? How should they consider inputs of raw materials during production that originated in third countries with a different CPS policy? One of the most important considerations, energy consumption from electric utilities, can vary widely based on location, time of year, and even time of day, while the prices of emissions credits also fluctuate over time. Even a customs authority with infinite analytical capabilities would be unlikely to obtain sufficient data to perform carbon lifecycle analysis for an individual import. Such data may be proprietary, sensitive, or difficult to manage, compile, or transmit.

So, what is a customs authority to do - assume the average carbon intensity of products in a given sector? This is a problem, because any imprecision constitutes carbon leakage and an opportunity for reshuffling. Underestimation of carbon intensity gives the exporter a competitive advantage and constitutes carbon leakage. Overestimation constitutes an undue tariff. However, if the importer can get away with it (avoiding a WTO challenge), this overestimation would be virtuous, benefiting the higher CPS economy at the expense of the lower CPS economy. Therefore, an importing country is incentivized to assume the highest reasonable carbon intensity of a given product that it can get away with without violating WTO rules. This is a special case in which the selfish interests of a customs authority to collect revenue are aligned with the global interests of mitigating climate change. Given the complexity of the practice, WTO adjudication is likely to be a high bar, giving customs authorities significant latitude. On this climate issue, greed can be good.

The posture of a customs authority would therefore benefit from being highly averse to climate risks, shifting the burden of proof to producers to demonstrate that their carbon intensity is lower than assumed. This practice can seem like a creep toward protectionism, but tariffs on products with high carbon footprints is good for climate mitigation. Furthermore, it is the exporting country's choice to impose climate costs on the world without instituting a sufficient CPS. If the exporter instituted a CPS that matched or exceeded its trading partner's CPS, no CBA would be allowed on its exports. Therefore, the taxed exporter has no valid basis for complaint. The CPS/CBA importer does not need to pay a price for an exporter's unwillingness to regulate GHG emissions, which do not obey international borders.

The EU plans to incorporate some of these ideas, but to a very limited extent. In the absence of data, the EU allows CBA calculations to be based on the worst 10% of emitters in the EU

or average emissions in the exporting country.[170,171] However, if the importer's emissions are higher than the EU's worst performers, which is likely given the EU's relatively low emissions, even this seemingly conservative approach could allow carbon leakage and market advantages to imports.[172] A better approach would be to assess carbon intensity based on the worst 10% emitters in the *exporting* country unless the exporter can prove otherwise. Shifting the burden of proof to emitters can be a powerful tool to generate virtuous revenue and advance climate goals.

Enforcement institutions should also be warry of imprecision in how sectors are defined, which can also enable carbon leakage and reshuffling. An example of such unintended consequences is the raising of emissions standards on U.S. vehicles while exempting large vehicles, intending to exempt those used in construction and agriculture.[173] In response, U.S. car companies increased the sizes of their road-bound trucks to evade those regulations. This is an example of reshuffling and carbon leakage within a domestic economy, and the same can occur internationally. The more precise the definitions, the less risk of leakage and reshuffling, but the higher the administrative burden. Both are avoided by engineering simpler CPS policies that tax fossil fuels early in the supply chain. Multilateral agreements would eventually bypass the issue entirely, but complex unilateral regimes need to exist to create imbalances before there will be sufficient political will to find multilateral solutions.

This section has discussed the assessment of CBAs on imported goods. However, the other side of CBA enforcement is the assessment of CBA deductions on the basis of carbon pricing already paid in the exporting country. This deducation is required to maintain WTO compliance. The type of CPS policy in the exporting country makes a big difference. An explicit carbon tax is the easiest to deduct, especially for raw materials. A product exported from an emissions trading economy is more difficult, as prices of emissions credits are inherently dynamic. Pricing could be justifiably determined at the time of emission, or it could be based on the price of credits at the time of import. Non-fiscal carbon pricing (e.g., emissions standards, bans) is the most difficult to calculate, likely to be ignored, and is not even considered by the EU CBA. Similar to calculating carbon intensity, calculating CPS deductions rely on sophisticated carbon lifecycle analysis, because different types or levels of pricing may have been applied or exempted throughout the production of a given import. This is a highly complex and administratively taxing dynamic, which illustrates the importance of multilaterally aligned CPS/CBA policies and of simple CPS policies like carbon taxes, applied early in a supply chain. In the absence of multilateral alignment, CBA rebate enforcement would be wise to shift the burden of proof to the exporter, the trustworthiness of which can be established by sampling cases rather than

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170 Joachim Englisch, Tatiana Falcao, "EU Carbon Border Adjustments for Imported Products and WTO Law," SSRN (2021) <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3863038>.

171 Giulia Claudia Leonelli, "Export Rebates and the EU Carbon Border Adjustment Mechanism: WTO Law and Environmental Objections," Journal of World Trade, Vol. 46, pp. 963-984, <https://kluwerlawonline.com/journalarticle/Journal+of+World+Trade/56.9/TRAD2022040>.

172 Joachim Englisch, Tatiana Falcao, "EU Carbon Border Adjustments for Imported Products and WTO Law," SSRN (2021) <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3863038>.

173 Aarian Marshall, "The U.S. Wants to Close an 'SUV Loophole' That Supersized Cars," *Wired*, April 14, 2023, <https://www.wired.com/story/the-us-wants-to-close-the-suv-loophole-that-supersized-cars/>.

case-by-case lifecycle analysis. This still requires an investment in this capability, but at a much smaller scale.

Customs and trade officials should not merely enforce a climate-conservative CBA but push trading partners to do the same. CBA exemptions should be off the table in trade negotiations, both because of the importance of robust CPS and CBA policies and because exemptions would compromise the legitimacy of the CBA under the WTO.

In the meantime, supply-side policies can be quickly integrated into existing control frameworks, licensing fossil fuel exports on the basis of relative climate risk to control and ultimately reduce the global supply of fossil fuels. The same analytical practices will be employed in the enforcement of a demand-side CBA, so the implementation of one sets the stage for the other. With both sides of the policy scissors, customs authorities can both enhance economic competitiveness and counter the proliferation threat of fossil fuels.

Part 6: Summarized Conclusions and a Political Roadmap

This article does not merely propose a set of policy options, it describes an evolving policy landscape that customs and trade officials are facing, now. The EU has already begun implementing a CBA, and disparate CPS policies have been implemented around the world for decades. Norms are shifting in climate politics, and looking ahead an additional 5-10 years, there are investments that need to be made, now, in preparation. There are strategic and financial rewards to be reaped by first movers.

To mitigate greenhouse gas emissions and mitigate the existential climate threat, strategic trade management, licensing and customs authorities should advance, and be prepared to implement, export controls on fossil fuels, their derivatives, and mining and deforestation technologies. They should declare fossil fuels to be a proliferation threat, and leverage nonproliferation infrastructure to mitigate climate damage.

To further this mitigation, lessen economic distortion, and gain virtuous revenue from non-CPS economies, countries should advance and implement carbon border adjustments. This policy should not be an afterthought of a domestic pricing scheme, but a forward-leaning strategy to enable efficient and effective carbon pricing policies. They should also do so to create virtuous trade imbalances that mollify domestic political concerns and compel trading partners to implement and align their own carbon pricing schemes. Authorized on the basis of protecting against the damages of climate change, carbon border adjustments are strategic trade controls and valid under WTO general exemptions.

These supply-side and demand-side strategies will require strategic trade management, licensing, and customs authorities to make investments in climate and carbon lifecycle analysis expertise, assessments of countries' carbon pricing policies, multilateral sharing of best practices (especially with the EU), and assessments of countries' immediate and long-term climate risk to deliberately wean them off of fossil fuels. Not necessarily known as the most forward-leaning, innovative, or responsive of political institutions, customs and trade institutions should start investing right away.

The international political roadmap to a sustainable energy economy may begin with a virtuous but messy grab for CPS revenue and disparate CPS policies and enforcement regimes, buffeted by the whims of domestic politics and the specific circumstances of trading relationships. The EU has been the first and biggest such domino to fall. As more countries demonstrate CBA revenue, more will seek to do the same or at least implement a CPS to recover that revenue lost to their trading partners with a CBA. As more countries implement carbon pricing, the market will finally favor investments and innovations in alternative technologies without specific subsidies and industrial policy. Eventually, that revenue and leverage of unilateral policies will become overwhelmed by the administrative burdens and economic distortions they cause in international trade. This pressure to align CPS and CBA policies through multilateral regimes, just like those which evolved out of nonproliferation trade controls, will constitute the ultimate path to a sustainable global carbon economy. The sooner such a multilateral regime emerges, the better.

Institutions like the Wassenaar Arrangement, the World Customs Organization, the World Trade Organization, the Organization for Economic Cooperation and Development, and other international forums could choose to confront the growing complexity and potential chaos of unaligned carbon pricing schemes and border adjustment policies. As these policies are aligned, border adjustments become less burdensome, complex, protectionist, and necessary. If the world meets its net-zero commitment by 2050, CPS and CBA policies will become decreasingly necessary as the market for fossil fuels diminishes. However, like with traditional proliferation threats, trade controls on fossil fuels should remain permanent to prevent relapse. A new fossil fuel nonproliferation treaty and multilateral control regime is needed to align such policies for the long term.

This progress will test the scope of the WTO GATT Article XX general exemption “to protect human, animal, or plant life or health” in a time where the WTO framework is under strain. The WTO should allow any trade control or border adjustment which seeks to mitigate greenhouse gas emissions, even as a tool to incentivize such policies in other countries. The global community should not tolerate attempts to evade carbon pricing. Given the urgency and extent of the climate crisis, WTO countries should prioritize even modest climate progress over open trade. Tolerating countries’ continued externalization of climate costs is neither fair nor secure.

Strengthening Global Strategic Trade Controls through Focused Stakeholder Ecosystem Assessment, Engagement, and Capacity Capture

SHAWN BAKER-GARCIA AND MOHAMMED AL SHARAA[1]

Abstract

The current atmosphere of accelerated technological innovation and unregulated access to that technology is unfolding amid the backdrop of active global wars, regional conflicts, and high stakes natural resource and economic competition. The convergence of these dynamics may open the door to increased deliberate or incidental misuse of sensitive controlled information and materials. Such a risk threatens to compound the aforementioned conditions at a time when the international community faces increasing and competing priorities and a finite supply of human and financial resources with which to address these issues. This article explores the role of Strategic Trade Control (STC) as a powerful tool for addressing many of the threats and security risks facing humanity today. It offers three key areas for consideration: 1) the

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unique potential of STC to positively impact today's global security climate, 2) the utility behind a smartly connected and understood STC stakeholder ecosystem, and 3) the criticality of operationalizing and sustaining, or "capturing" STC capacity development outcomes. Recommendations are given for how to pursue and achieve success in each of these areas as a means to improve STC compliance and by extension, global security. Contextualizing the impact of STC on global security, defining the STC stakeholder ecosystem, and applying a simple but effective capacity development framework known as "Capacity Capture" offers the opportunity to build a more representative STC ecosystem rapidly and effectively while improving coordination and competencies at a time when they are most urgently needed.

Keywords

Global security, stakeholder ecosystems, operationalizing capacity, strategic trade control

Key Terminology

- **Stakeholder:** any individual or group of individuals (public or private) impacted by or having an interest, stake, role, or responsibility in some shared issue, goal, or initiative.
- **Ecosystem:** the body of stakeholders working on a defined issue, goal, or initiative and the conditions, dynamics, and bureaucracies that characterize their connectedness and interactions.
- **Ecosystem Mapping and Assessment (EMA):** the diagraming and linking of all stakeholders within a specified ecosystem and analysis of inter/intra relationships, mission areas, behaviors, and other conditions or dynamics that elicit actionable data about the ecosystem.
- **Capacity Development:** any activity, engagement, or interaction designed to raise awareness, build, or evolve professional cultures or norms, and/or expand or enhance specified competencies or capabilities.
- **Capacity Capture:** the operationalization of capacity development outcomes, initiatives, action plans, and policy frameworks to advance, enhance, and sustain ecosystem performance and effectiveness.

I. The Role of Strategic Trade Controls in Global Security

STC plays a pivotal role in contemporary global security. The world continues to live at the crossroads of increasing interconnectedness and diffusion of new technologies that offer extraordinary peaceful use applications that may also be exploited for non-peaceful purposes. To stay ahead of and effectively plan for response to the myriad evolving global security trends and threats, those in the STC and nonproliferation communities will need to reconsider and adapt mental models, policy prescriptions, practices, and coordination competencies wherever possible. The proliferation of Weapons of Mass Destruction (WMD) and conventional arms demands rigorous STC regulations to be uniformly understood and applied to prevent misuse. A globalized supply chain necessitates a comprehensive STC framework to mitigate the risks associated with controlled goods and technology from falling into the wrong hands.

With that in mind, some dynamics that demonstrate how and where STC is impacted by or plays a role in global security include:

- New technologies: The rapid onset of emerging dual-use technologies, such as artificial intelligence (AI) or those associated with hypersonic weapons, as two examples, poses new challenges to existing STC implementation and compliance and may necessitate augmentation of, if not entirely new, regulatory frameworks.[2,3] AI and hypersonic technology particularly have both civilian and military applications that make it difficult to distinguish between legitimate and illegitimate transfers. These new or emerging technologies challenge STC regimes because of 1) rapid onset (use outpaces policies controlling use), 2) low barrier to access (meaning many people or certain stakeholders have easy access to the technology), and 3) difficult-to-predict or myriad known ways in which the tech can be nefariously used.

- Nation state monopolies on critical natural resources: the current race to protect rare earth elements and supply chains of critical technology like semiconductors may increase risk if undertaken too hastily and without the appropriate STCs in place.

- An increasingly interconnected global economy: The growing interconnectedness and complexity of the global economy, both in the virtual (for example, dark web transactions) and physical (for example, ungoverned spaces, easy to replicate manifests) sense, makes it increasingly difficult to track and control the flow of goods and technologies.

- Non-state and state actor activities: The nefarious behavior of state and non-state actors and national competitive instincts or corruption continues to challenge STC compliance; the former being less susceptible to traditional diplomatic and economic pressures, and the latter being difficult for many countries to change on the systemic level despite best intentions or efforts.

- Global conflicts: Ongoing war and escalating armed conflict create "fog of war" conditions for those who wish to exploit or profit off such human tragedy. These conflict conditions provide cover for traffickers and opportunities to pilfer dual-use assets.

- Outmoded international relations mindset: Adherence to "great power competition" or "zero sum" security mentality and strategies inhibits creativity of thought and finding new solutions to existing problems or contemporary challenges. To improve outcomes, mental models that govern and inform subsequent policy and action must also change, which leaves room for improved stakeholder representation, connectivity, and cooperation on STC and other issues.

To confront and address the above and mitigate the challenges posed by the proliferation of

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2 "Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence," The White House, October 30, 2023, <https://www.whitehouse.gov/briefing-room/presidential-actions/2023/10/30/executive-order-on-the-safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence/>.

3 "Urging an International AI Treaty: An Open Letter," AI Treaty, <https://aitreaty.org/>.

sensitive goods and technologies, effective stakeholder cooperation is essential. International agreements and regimes that support robust STC efforts provide frameworks for countries to work together to prevent the illicit use, trade, movement, or proliferation of controlled items. However, in nearly all cases, there is scope to improve cooperative efforts and compliance outcomes.

Here are other areas where cooperation in STC can be enhanced:

Harmonizing Standards

Global STC leaders are working to develop export control standards for critical and emerging technologies, but reaction times must be quicker and more decisive while remaining well-thought out and sustainable. STC stakeholders should consider drafting a playbook for systematically preempting or identifying, deliberating on, and drafting new or evolved standards for breakout technology or other dual-use information or materials. Doing so would result in a confident, deliberative, and responsive approach and more consistently reliable STC adoption and compliance outcomes.

Information Sharing

Countries need to share information or intelligence more regularly and effectively to support robust STC enforcement. Doing so has the dual benefit of strengthening national STC compliance while simultaneously improving national and regional border security. Countries may consider sharing information about:

- Illegal trafficking, terrorist, or proliferation networks and any known or suspected activities.

- Shippers, end users, freight forwarders, transportation companies, or other stakeholders involved in the movement of goods across borders.

- Commodity control and other specialized verification, user, or "parties" lists to harmonize lists and thereby prevent incidental or accidental loopholes.

- Commodity licensing updates, requirements, or known or suspected licensing breaches so that bordering countries have an opportunity to adopt the same import/export best practices or standards.

- Customs and border operations procedures and protocols to synchronize cross-border operations aimed at increasing faster and more accurate identification of attempted illicit movements, mitigating diversion attempts, hastening processing times and queue lines to keep licit trade and transfer or people moving as quickly as possible.

In countries and regions where active conflict, known or sustained non-state criminal or terrorist activity, historically fluid or difficult to police green borders, economic hardship, and/or natural resource, or climate-induced challenges are combined with even modest access to dual-use or precursor materials and technical "know-how," risk and vulnerability is created for citizens of

those nations, regions, and indeed the world. Coalescing and focusing stakeholder attention to strategic communication and information sharing is a potent and appropriate tool to mitigate the risks posed by poorly or inconsistently enforced STCs.

Capacity-Building

Most countries would benefit from collaborative and made-for-their-ecosystem approaches to develop, implement, and manage effective STC regimes. STC ecosystems are essentially living, continually evolving, communities of stakeholders with some specific contribution to or responsibility for pursuit or application of robust STC regimes or are somehow impacted by or are expected to adhere to those regimes. At the national level, public entities such as customs, national security or defense agencies, law enforcement, intelligence, and regulatory authorities as well as private sector entities such as professional associations, nongovernmental organizations, universities, and businesses and companies dealing in import or export of dual-use materials or information are all unique stakeholders within this dynamic STC ecosystem.

Beyond the national scope, international partners (other governments or nongovernmental entities), multilateral organizations, and regional centers or coordinating bodies must also be considered part of these national ecosystems as frequently it is the international entities, such as the World Customs Organization (WCO), specialized United Nations (UN) program offices, NATO, EU CBRN Centers of Excellence, EU Partner to Partner (P2P), and/or U.S. government agencies like the Department of State are often sponsors of STC capacity development programs or initiatives. These capacity efforts can result in sustained engagement of similarly interested global practitioners and often seek to advance specific STC related knowledge, competencies, and harmonization among and between global partners.

To ensure capacity development activities, goals, and implementation strategies are appropriate to different national STC ecosystems, and will yield optimal outcomes, it is essential that non-national stakeholders develop an authentic and ongoing understanding of these ecosystems. It is not enough to read a national government or bureaucracy organizational chart or memorize a country's various STC related national policy frameworks. It is neither sufficient to assume stakeholders know certain information nor helpful to approach stakeholders without doing homework on their ecosystem up front. And it is essential to lead an interaction acknowledging an awareness that this may be the nth time they have communicated to some well-intended external entity the same pain points, gaps, priorities, and other self-assessments of their national STC "health." This establishes immediate parity, candor, and demonstrates a level of awareness and commitment that will yield more nuanced feedback while creating a safe space for partners to ask questions they may be otherwise hesitant to ask to avoid appearing uneducated on certain topics or terminology.

This will generate more precise stakeholder feedback about what is or is not viable or relevant to their needs, priorities, and interests. This in turn would increase the likelihood that whatever capacity development offerings result, have a higher chance of being successfully absorbed, operationalized, and sustained post-engagement. And when new or evolved knowledge, practices, skills, or tools are absorbed, operationalized, and sustained, global security is strengthened.

Leveraging Local, Regional, and Global Expertise and Resources

The global STC ecosystem is vast and diverse, which makes it a challenge to achieve cohesion and integration. Government and multilateral organization stakeholders have an opportunity to build public-private partnerships, leverage academic, professional association, and civil society organization expertise and resources to build depth of knowledge, design and deliver effective messaging/socialize campaigns for different stakeholder groups, and gain traction on meeting national STC compliance goals. For example, not every country faces the same government-industry relationship dynamics or motivating behaviors surrounding regulatory regimes. In 2015, the U.S. Department of State supported a meeting that brought Iraqi industry together with their government regulatory authorities expecting to have to convince the industry partners to be cooperative about chemical regulations. In fact, the nascent Iraqi private chemical sector was eager to work with government to adopt regulations. Doing so would enable them to prove compliance thereby preventing their chemical inventories from being seized by law enforcement entities who were not always clear on which chemicals were licit and licensed and those that were illicit or unlicensed. This is just one example of cultural or societal dynamics characterizing or influencing national public-private relationships. Additional factors impacting a state's STC health include economic systems, bureaucracy structures, threat or security conditions, and geopolitical realities. Meeting STC goals can best be achieved when a contextualized, whole-of-ecosystem understanding of STC stakeholders and relationships is applied.

Law Enforcement Cooperation

Countries need to find ways to work together to investigate and prosecute violations of STC regulations. This could involve development of joint cross-border investigation protocols, harmonization of key terms and references, brokering of evidence sharing agreements, and reaching an understanding on the terms surrounding extradition of individuals suspected of violating STC regulations. For example, some countries in Southeast Asia have different data protection laws that may prohibit or restrict the types or extent of information that can be shared with other countries about suspected or alleged traffickers.[4] Specifically, Laos and Thailand have legal limitations on sharing information on local nationals with other countries. These limitations can impose roadblocks on what information can be shared on persons of interest that may be trafficking illicit materials across borders or the utilization of a be on the lookout (BOLO) warning for other law enforcement agencies and the public. Deconflicting such laws or finding solutions to compliantly cooperate with regional or international illicit trafficking investigations in such circumstances, is essential.

4 Shawn Baker-Garcia, Bangkok, Thailand, U.S. Department of State sponsored, Coalescion implemented, Golden Triangle River Vessel Weapons of Mass Destruction Interdiction Initiative, September 4-8, 2023.

II. The STC Stakeholder Ecosystem[5]

To function optimally and achieve shared goals in a timely manner, it is necessary for countries and global STC leaders to map and understand the stakeholders within the broader global and national level STC ecosystems. These "living" ecosystems mapped would show a complex web of stakeholders, their interactions with each other, and the systems or dynamics that drive stakeholder behaviors, interests, and priorities. Within the STC ecosystem, stakeholders consist of key individual practitioners (experts or leaders), government agencies, private sector entities, multilateral organizations, and nongovernmental organizations including academia and civil society. These stakeholder groups may be influenced or impacted by or in a position to contribute to or further national STC framework development and compliance efforts, each bringing a distinct role, perspective, audience, or capability. As such, it is essential to develop an engagement strategy that works to build a distinct STC ecosystem identify comprised of all the relevant and interested stakeholders. One way to do this is to coalesce stakeholders at specified intervals with a clear purpose and outcome in mind. That could be to develop a shared understanding of each other and each's unique role or responsibility within the STC ecosystem. With improved understanding of each other, it is more likely that meaningful friendships, partnerships, and collaborative efforts will ensue. It will also ensure that when they disperse back to their respective home institutions, their "individual" efforts have a better chance at being harmonized, integrated, and efficiently designed to support broader, shared STC goals. Understanding and harnessing the power of an STC ecosystem facilitates inclusion of impacted voices and expertise which improves subsequent stakeholder planning, actions, and buy-in; all of which are pivotal to raising STC awareness, improving STC compliance, and identifying and addressing STC-related capacity development needs.

Each of the above-identified stakeholder groups have a unique role and perspective to contribute to the STC ecosystem. For example, government agencies have the authority to develop and enforce STC regulations, while individual practitioners have the expertise to inform, advise on, or implement regulations. Civil society organizations can provide a valuable outside perspective and niche legal or other expertise in the development or deployment of STC related national policies, frameworks, or compliance planning and can help ensure STC policies are grounded, fair, and transparent. The private sector can provide insights into the practical challenges of implementing STC regulations and help to develop solutions that are both effective and efficient. Multilateral organizations can help to promote international cooperation and harmonize national STC frameworks.

It is important to engage all relevant stakeholders in STC policy development and implementation. This ensures that all perspectives are considered and that the resulting policies are feasible and effective. Stakeholder engagement can also help to build support for STC and promote compliance by giving stakeholder groups a seat at the table and ability to shape policy requirements and outcomes. That said, if this was easy or predictable to do, many countries would already be doing it. The following challenges may get in the way of effective stakeholder

5 "Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence," The White House, October 30, 2023, <https://www.whitehouse.gov/briefing-room/presidential-actions/2023/10/30/executive-order-on-the-safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence/>.

and ecosystem coordination:

- Differing or conflicting interests: Stakeholder groups may have differing, if not outright conflicting, interests and priorities when it comes to STC. The most obvious and known example is private sector focus on minimizing the burden of STC regulations, while government and civil society organizations are often focused on maximizing the effectiveness of and compliance with STC regulations.

- Lack of clarity or confusion about roles and responsibilities: Stakeholder groups may not fully understand their or others' roles, and/or may see healthy overlap of capabilities or responsibilities as competition; alternatively, they may reject certain capabilities or responsibilities seeing them as in the purview of other stakeholder groups.

- Lack of a coordinating ecosystem entity: It is often helpful to build a deliberate and identifiable STC ecosystem along with sub-ecosystems (industry, academia, law enforcement, policymakers, etc.), however that is not always easy to do or maintain without a willing and reliable coordinating entity or individual(s).

- Lack of an established coordination mechanism(s): There may not be any established forum to coalesce the ecosystem outside of ad hoc meetings or outside of high-level policy discussion engagements.

- Lack of awareness: More traditional stakeholders in the ecosystem (government, industry) may be unfamiliar with or unclear as to the role of less traditional or newly emerging stakeholders within the "system," which can result in those stakeholders going unrecognized or actively left out of important STC conversations and initiatives.

- Lack of resources: Some stakeholders may lack the resources to participate effectively in the stakeholder engagement processes.

Overcoming the above stated and other challenges to global STC goals can be done at many levels including but not limited to the following:

- Cultivate and reinforce a STC "ecosystem identify:" talk about and define the STC ecosystem and champion a "whole of ecosystem" approach to national and international STC goals.

- Conduct stakeholder identification and ecosystem mapping: It is important to know which stakeholders can or should be involved in or are impacted by STC policy development and implementation. This can be done in a mapping exercise that defines the criteria for who is part of that ecosystem, lists all vested stakeholders and their respective roles, mission lines of effort, and interests, and draws connections for how these stakeholders could be, or are not connected and provides some actionable analysis for why this information matters.

- Develop stakeholder and/or ecosystem engagement plan(s): Once key stakeholders have been identified and the ecosystem has been mapped, it is important to develop a

stakeholder and/or ecosystem engagement plan. This plan should 1) outline engagement objectives, 2) list specific stakeholders to involve, and 3) communicate engagement mechanisms to be deployed.

- Diversify engagement methods and report on outcomes (particularly successes): It is important to use a variety of interaction and coordination methods to ensure inclusion of all the different stakeholders. Engagement modalities include but are not limited to meetings, workshops, seminars, and consultations. When engagements produce tangible results, spread the word so others can build their understanding of how to achieve or replicate such successes. Where it goes less well, talk about that as well so the community can learn from each other.

- Provide or seek training and resources: Where stakeholders lack awareness of STC issues or the nature or importance of their role or contribution, it is important to provide them the relevant training and resources to improve awareness and role clarity. Ways to do this include developing and disseminating educational content and materials, providing access to experts, and offering financial support.

In the absence of a defined engagement strategy, at worst, multi-stakeholder coordination and cooperation will be messy, complicated, unproductive, and delay or obstruct progress. At best, it may give stakeholders a false sense of forward motion. However, by applying the above recommendations, policymakers and other STC leaders and advocates can overcome such stakeholder engagement challenges and hasten progress on shared goals, foster mutual understanding among stakeholders, and ensure that stakeholder voices are reflected and represented in STC policies, guidelines, and practices to improve buy-in and compliance outcomes.

III. STC Ecosystem Engagement and Capacity Capture

As mentioned in the above section, multistakeholder engagement outcomes are neither guaranteed nor always intuitive in the absence of deep stakeholder knowledge. Knowing how and when to coalesce stakeholders, when to engage them directly, when to leave them to their stovepipe, and toward what end one is convening them, is one part art and one part science. It is imperative to intimately understand all the stakeholders, their roles and responsibilities, and areas of connectivity, friction, or overlap as well as traditional cultural and sectoral cultural dynamics that inform their relationships and behaviors. There is no established or accepted multi-stakeholder engagement "playbook" to coach these principles and engagement strategies despite nearly all STC goals being dependent upon the successful coordination of multitudes of stakeholders. Finding ways to reflect the totality of perspectives requires academic study but more importantly, requires practical interactions facilitated by masterful and trusted "coalescers." Overcoming stakeholder disparities in awareness, interest, commitment, and compliance is a daunting task but can and must be done to improve STC systems and compliance with STC regulations. Below are entry points where the community could assert itself to immediately begin making traction:

Identify Capacity Gaps

- Human Resources: Many stakeholders, particularly in the private sector, are not aware of STC requirements or the importance of their role in complying with these requirements. This can lead to unintentional violations of STC regulations. There are also partners around the world for whom STC is a developing concept particularly in the context of countering WMDs or proliferation prevention. Customs, law enforcement, and border protection personnel training on STC concepts and linkages to their unique job responsibilities is a capacity development gap that can be easily addressed with focused intention.

- Financial Resources: Regardless of whether a stakeholder is part of the public or private sector, funding is almost always less than requirements demand. Stakeholders would benefit from learning about specific financial planning tools and strategies so they can better predict and identify paths to meet financial requirements, e.g., sources of revenue or funding and efficient ways to leverage limited or discrete funds would improve STC outcomes and stakeholder relationships (less friction, more cooperation). In cases where international donors provide training, awareness raising, or material support, they should also carve scope and budget to provide end-users coaching on sustainable budget practices and financial planning sessions to 1) ensure that operationalizing capabilities is at the forefront of their minds, and 2) set the expectation from the beginning that recipient partners have a plan for integrating new material or human resources into their new capabilities or capacities.

- Material Resources: Many stakeholders lack the material resources to develop and implement effective STC systems or processes. This can make it difficult to comply with STC regulations and prevent the proliferation of sensitive goods and technologies. For example, important detection and analysis training provided to partners around the world is not always accompanied by the specialized equipment needed to apply learned skills. Conducting pre-training assessments on partner ability to support material requirements would ensure learning outcomes are both operationalizable and sustainable.

- Authorities and Leadership Nodes: Understanding where authority figures and leadership nodes exist within STC ecosystems makes it possible to surgically engage and integrate them into STC capacity planning and development. Their early buy-in and awareness of broader national STC capacity goals offers them an opportunity to contribute or allocate resources to build partner stakeholder capacities or to request capacity support as the ecosystem pursues shared goals.

- Process and Protocol: Different stakeholder groups may have different STC interests and priorities. For example, the private sector may seek to minimize the burden of STC regulations, while civil society organizations may seek to maximize regulatory effectiveness. Conflicting goals may make it difficult to reach consensus on STC policies and programs. In other circumstances, neighboring partners may adhere to different procedures or protocols in their assessment, handling, and/or search of controlled dual-use items or sensitive cargoes. In those cases, it would be beneficial for liaison teams to build strong relationships with their counterparts to assess where process and protocols are in harmony or at tension to avoid border control or transit loopholes.

To address the above requires some combination of the below, and potentially other, solutions:

Capacity Solutions

- Technology: Technology can be used to improve stakeholder engagement and capacity development in a number of ways. For example, online learning platforms can be used to provide training on STC issues to stakeholders all over the world. Social media can be used to raise awareness of STC issues and facilitate communication between stakeholders.

- Cross-sector collaboration: Cross-sector collaboration can help to overcome the challenges of STC stakeholder engagement and capacity development. For example, government agencies, the private sector, and civil society organizations should work together to identify, develop, and facilitate training programs, share resources, and advocate for STC policies.

- Engaging civil society and the private sector: Civil society and the private sector can play a valuable role in STC capacity development. Civil society organizations can raise awareness of STC principles or challenges, champion less engaged or underrepresented stakeholder and sub-stakeholder communities to bring them into the ecosystem, provide competency building training on different elements of STC implementation, and advocate for comprehensive, resilient, and up to date STC policy frameworks, guidelines, and outreach strategies. The private sector can also provide financial support for STC capacity development programs, share, or bring awareness to different community resources or tools, and offer specific technical or other expertise in support of national STC goals or needs.

Capacity Development Modalities

- Online learning platforms (tool): Online learning platforms can be used to provide training on STC issues to stakeholders all over the world. This is particularly beneficial for stakeholders spanning multiple locations or countries, or stakeholder communities who may not have regular or easy access to traditional training programs.

- Webinars and E-Learning (instruction): Webinars can be used to provide training on STC issues to stakeholders in a convenient and cost-effective way. Webinars can also be used to facilitate dialogue between stakeholders from different sectors. E-learning modules can be used to provide self-paced training on STC issues to stakeholders. This is particularly beneficial for stakeholders who are busy and have limited time for training.

- In person engagement, coaching, and capacity-building: Creating networks of nongovernmental practitioners and organizations who have expertise in STC, or some specific or ancillary aspect of this disciplinary "field" is crucial to maintain a consistent source of individual and group training, mentoring, advocacy, and professional development. Building enduring rapport and relationships provides opportunities for knowledge cross-pollination and global connectivity among counterparts. Regular meetings, convenings, short courses, and one-on-one coaching can be effective and reinforcing for professionals who may otherwise feel under-engaged or confused about

how and where to maintain their professional "edge."

- Social media: Social media can be used to raise awareness of STC issues and facilitate communication between stakeholders. For example, government agencies can use social media to share information about STC regulations, official resources, and upcoming events. Civil society organizations can use social media to advocate for stronger STC policies and share resources on STC issues.

Cross-Sector Collaboration Value

- Establish cross-sector working groups: Cross-sector working groups can be established to bring together stakeholders from different sectors to discuss STC issues and develop solutions. For example, a working group could be established to develop a training program on STC for customs officers and private sector export compliance professionals.

- Organize joint events: Government agencies, civil society organizations, and the private sector can organize joint events on STC issues. This could include workshops, conferences, and seminars. Joint events provide an opportunity for stakeholders to learn from each other and share best practices.

- Develop partnerships: Government agencies, civil society organizations, and the private sector can develop partnerships to work together on STC capacity development projects. For example, a government agency could partner with a civil society organization to develop a training program on STC for customs officers.

Civil Society and Private Sector Contributions

- Civil society organizations: Civil society organizations can play a valuable role in STC capacity development by:
    - Providing training on STC issues to all ecosystem stakeholders.
    - Providing platforms for integrating or amplifying new or traditionally underrepresented stakeholder voices.
    - Conducting STC awareness raising campaigns, outreach strategies, and advocating for STC policies.
    - Monitoring STC regulatory compliance and providing early warning information to authorities where suspected breaches or vulnerabilities in the STC regime are occurring.
    - Conducting STC research and analysis.
    - Advising policymakers and other public sector stakeholders.

- The private sector: The private sector can play a valuable role in STC capacity development by:
    - Providing financial support for STC capacity development programs.
    - Sharing expertise on STC compliance best practices.
    - Developing and implementing innovative STC solutions.
    - Providing current information to the ecosystem about dual-use technology innovation and application trends.

Policymakers can create a more robust and effective STC system by engaging civil society and the private sector in STC capacity development efforts. And all stakeholders should start local and actively seek opportunities to leverage technology. There are multiple entry points for stakeholders to make a positive impact within STC. Utilizing technology in new and creative ways for training and capacity development, championing cross-sector collaboration, creating modalities and forums that nurture ecosystem self-identification and cohesion, conducting outreach and integration of the whole ecosystem, and tapping into and leveraging the STC ecosystem (national and global) for expertise and resources, are just some examples.

IV. EMA and Capacity Capture

To achieve more actionable, representative, and viably implemented stakeholder engagement and capacity development outcomes in STC policy design and compliance efforts, this article suggests utilization of two distinct approaches: EMA and Capacity Capture.

1. Ecosystem Mapping and Assessment (EMA): A thorough yet practical analysis of the STC ecosystem to identify key players, their roles, and their influence on policy development and compliance. Understanding a stakeholder ecosystem's intricacies can aid in crafting targeted strategies and initiatives to improve STC outcomes.

2. Capacity Capture: This is a reference to a distinct method applied by Coalescion, a U.S. nonprofit organization whose mission is advancing and operationalizing global security literacy, representation, outcomes, and human interaction models. Coalescion's "Capacity Capture" process provides implementers and recipients of capacity-building training, or engagements a framework for identifying specific acquired knowledge, practices, skills, and tools (KPSTs) and process for how to operationalize those new KPSTs back in their home environment. This operationalizing element is a precursor to sustainment yet is frequently if not entirely overlooked as a focused competency and goal of global security cooperation activities.

Figure 1. The Capacity Capture logo as applied by Coalescion in its work is trademarked; the phrase Capacity Capture is not.



Awareness, adoption and application of EMA and Capacity Capture strategies and principles will produce a better informed, productively connected, and coordinated STC ecosystem by:

- Ensuring all relevant stakeholders are known, understood, and have a platform and inflection points to contribute perspectives, voices, innovation/ideas, and challenges throughout the broader ecosystem,

- Providing onramps to maintain awareness of evolving practices, assess capacity restrictions or leverage efficiencies, and identify specific mechanisms to enable optimal compliance with STC frameworks and guidelines.

- Enabling healthy and efficient information exchange within the ecosystem, and

- Cultivating a culture of and providing tools for self-assessment to identify and address stakeholder or capacity gaps within a given STC ecosystem.

Conclusion

STCs are at the very heart of many global security risks and existing, evolving, and rapidly emerging threats. If global STC stakeholders and their national counterparts are understood in the context of a STC stakeholder ecosystem, all stakeholders can be better leveraged in whatever their unique capacity to inform, advocate for, and operationalize STC frameworks. Doing so will result in a more uniform understanding and application of STC policies, higher compliance rates, and strengthened national and international security. In that process, EMA and Capacity Capture represent simple but important tools in the toolkit to be utilized. If done well and regularly, the result will be a more meaningfully understood, connected, coordinated, and effective STC ecosystem and with that a safer and more secure world.

Cooperative Nonproliferation Controls to Support Research and Security: Risks and Challenges in Research Institutions and Universities Offering STEM Degrees in Argentina

MARIA J. ESPONA AND MAYRA AMENEIROS[1]

Abstract

This publication analyzes the current situation in both public and private universities and institutions in Argentina by underscoring the multifaceted approach needed to counter the proliferation of CBRN (Chemical, Biological, Radiological, and Nuclear) weapons, emphasizing collaboration with various stakeholders beyond political, diplomatic, and military realms. The involvement of scientific and engineering communities is crucial. Efforts to increase global awareness regarding CBRN weapons will help reduce the potential misuse of STEM (Science, Technology, Engineering, and Mathematics) research findings. The results presented in this article reveal a significant gap in the curricula of research institutions and universities

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offering STEM programs. Despite the presence of various advisory committees, none of them currently address crucial topics related to CBRN weapons nonproliferation and disarmament. The absence of such content in academic programs may contribute to a lack of preparedness among scientists and engineers to identify potential dual-use research and address security challenges posed by CBRN weapons. The article demonstrates the importance of reevaluating and enhancing educational strategies within STEM fields to better equip future professionals.

Keywords

Dual-use, CBRN weapons, STEM degree programs, responsible use of science, Argentina, intangible transfer

Introduction

Since 2022, the authors conducted research with the primary objective of acquiring a comprehensive understanding of the landscape surrounding export control measures, intangible knowledge, responsible science, and dual-use research within STEM careers at Argentinian universities.[2,3,4,5] This pioneering initiative aims to illuminate the situation in a nation dedicated to nonproliferation and export control, delving into a domain that has, until now, been relatively well-explored only in Europe, the United States, and Japan.

2 Responsible science is defined as when "scientists are responsible for conducting and communicating scientific work with integrity, respect, fairness, trustworthiness, and transparency, and for considering the consequences of new knowledge and its application. The maintenance of ethical standards by scientists and their institutions is a prerequisite for trust in science by both policymakers and the broader public." International Science Council, <https://council.science/what-we-do/freedoms-and-responsibilities-of-scientists/ethical-responsible-conduct/>.

3 Dual-use can be defined as "knowledge, information, methods, products, or technologies generated by peaceful and legitimate research that may be appropriated for non-peaceful or harmful purposes." World Health Organization, "Global Guidance Framework for the Responsible Use of the Life Sciences: Mitigating Biorisks and Governing Dual-Use Research," Geneva, 2022, ISBN 978-92-4-005610-79l (electronic), <https://www.who.int/publications/i/item/9789240056107>.

4 Dual-use research can be defined as "research conducted for peaceful and beneficial purposes that has the potential to produce knowledge, information, methods, products, or technologies that could also be intentionally misused to endanger the health of humans, nonhuman animals, plants and agriculture, and the environment. In the context of this framework, it refers to work in the life sciences, but the principles are also applicable to other scientific fields." Ibid.

5 Of note: "*According to Sanders (2009), the National Science Foundation (NSF) in the 1990's began to use the acronym SMET, as a "… shorthand, for 'science, mathematics, engineering, and technology"' (p. 20). SMET was perceived to sound too much like "smut" and STEM, became the acronym of choice." See Willian F.* McComas, "STEM: Science, Technology, Engineering, and Mathematics," in: McComas, W.F. (eds) *The Language of Science Education*: Rotterdam, SensePublishers, <https://doi.org/10.1007/978-94-6209-497-0_92>.

Argentina has a solid nonproliferation and export control policy.[6] Through the authors' ongoing discussions with pertinent stakeholders, it was reaffirmed that there is a need for further enhancement of intangible transfer controls. The identification of this gap was the starting point for this article's research effort, which seeks to understand the current situation to be able to raise awareness among national authorities and help design a plan to address it. It is worth highlighting that individuals within the export control field, such as academics, scientists, engineers, and relevant professionals in STEM careers expressed their support for the proposed research this research undertaking and were enthusiastic about exploring potential individual initiatives to improve the situation within their respective educational institutions.

The primary goal of this article is to enhance awareness regarding local expertise in STEM fields pertaining to CBRN nonproliferation and disarmament. Additionally, it aims to offer recommendations on improving the oversight of intangible transfers and bridging the knowledge gap in this domain. This goal can be approached through diverse strategies; however, a root solution is to incorporate these topics into STEM degree programs. This equips students with knowledge about international Weapons of Mass Destruction (WMD)-related Treaties, Argentina's position in the global security landscape, initiatives undertaken by national and international institutions concerning the nonproliferation and disarmament, as well as fundamental security principles and dual-use terminology necessary for promoting safely and securely research practices. This research was structured to collect publicly accessible information concerning the topic while also incorporating input from key stakeholders to provide insights into their perspectives and potential courses of action. The article begins with an examination of the Argentinean policy concerning CBRN nonproliferation and export controls, offering insights into national commitments, requirements, and obligations. Subsequently, it presents a compilation of STEM degree programs available within the country. The article then delves into the outcomes of a survey conducted to gauge the current level of knowledge and awareness among a diverse array of stakeholders regarding these matters. Finally, the conclusion presents an analysis of these findings and outlines a series of propsed next steps.

Argentina's CBRN International Commitments and National Implementation

Argentina has actively pursued nonproliferation and disarmament of WMD policies, initiatives, organizations, and agreements since the 1990s. A summary of the general policies and agreements related to biological, chemical, and nuclear weapons in Argentina is shown in Annex 1. Argentina's National Commission for the Control of Sensitive Exports and War Material (CONCESYMB), which includes the Ministries of Defense, Foreign Affairs, and Industry, is the main body responsible for export controls.[7] Under Decree 603/92, its amending and complementary regulations, the CONCESYMB controls exports of dual-use, sensitive, and war material in compliance with Argentina's international commitments.

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6 Strategic trade controls encompass not only tangible goods but also the dissemination of knowledge and technology. This presents a unique challenge, as it includes aspects such as technical assistance, collaborative research and publication of findings and the methods through which this sharing occurs, such as online data sharing.

7 National Commission for the Control of Sensitive Exports and War Material (CONCESYMB), <https://www.argentina.gob.ar/defensa/comision-nacional-de-control-de-exportaciones-sensitivas-y-material-belico-concesymb>.

This Commission has several members:

- Ministry of Defense, which is the Executive Secretariat;
- Ministry of Foreign Affairs, International Trade and Worship (specially, DIGAN, the "Directorate of International Security, Nuclear and Space Affairs");
- Ministry of Economy;
- General Directorate of Customs, as the authority in charge of supervising compliance with export regulations.

For technical advice:

- CONAE (National Commission for Space Activities);
- ARN (Nuclear Regulatory Authority);
- CITEDEF (Institute of Scientific and Technical Research for Defense).

The Commission has a significant role in addressing WMD proliferation and associated technologies.

The CONCESYMB is empowered to grant Prior Export Licenses to transfer elements included in the Annexes of Decree 603/92, grant an "Import Certificate" at the request of an exporting country, authorize producers of war supplies or components to initiate negotiations to export these products abroad, and propose new legal norms that correspond to the guidelines adopted and to be adopted as well as to Argentina's international commitments.

The purpose of Argentina's export controls is to prevent any attempt at unauthorized export of sensitive or controlled war material. In addition, there are special registration requirements for companies dealing with controlled chemicals or munitions items.[8] In 2020, the Permanent Mission of Argentina to the United Nations presented to the Security Council Committee Argentina's comments to the matrix.[9] This Committee was established under United Nations Security Council resolution 1540. The matrix shows to what extent Argentina is committed to nonproliferation efforts and how national legislation and other measures adopted reflect this. It is notable that although intangible transfers are included within Decree 603/92 and mentioned in the matrix, the focus remains predominantly on tangible goods. Ongoing efforts are being directed towards the formulation of strategies for managing intangible goods. Regarding intangible transfers and responsible science, the only formal initiative identified in Argentina has been encouraged by the ANCAQ (Chemical Weapons Convention National Authority) and the OPCW (Organization for the Prohibition of Chemical Weapons) and is currently being implemented by the University of Cordoba.

Methodology

To understand the state of STEM degree programs at universities in Argentina, the authors designed an approach that includes a qualitative assessment (survey to key stakeholders)

8 "Argentina Export Control Information," Bureau of Industry and Security, U.S. Department of Commerce, <https://www.bis.doc.gov/index.php/enforcement/220-eco-country-pages/1052-argentina-export-control-information#:~:text=Export%20controls%20are%20administered%20by,controlled%20chemicals%20or%20munitions%20items>.

9 ENAUN Nº 327/2020, <https://www.un.org/en/sc/1540/documents/ArgentinaReport10July2020.pdf>.

and a quantitative assessment (a structured OSINT search). In addition, the authors included several individual initiatives that were identified, such as the courses given by the University of Cordoba on chemical weapons and dual-use. The objective of this approach is to identify whether universities offering STEM degree programs have courses that include concepts of dual-use research, CBRN nonproliferation, biosafety, biosecurity, chemical and nuclear security. The research also analyzed the opinions of relevant stakeholders.

The authors sent the survey to key stakeholders. The survey included questions about their profession, their area of work, as well as the following:

1. *Responsible conduct of research (RCR) is defined as "the practice of scientific research with integrity." It involves the knowledge and application of established professional standards and ethical principles in the performance of all activities related to scientific research. 1.A) Did you know this term/definition? What is your opinion about it?*

2. *In politics, diplomacy, science and technology, and export control, dual-use items refer to goods, software, and technology that can be used for both civilian and military applications (or that have both beneficial and malign uses). More broadly, dual-use can also refer to any good or technology that can satisfy more than one purpose at any given time. 2.A) Were you familiar with this term/definition? What is your opinion on this?*

3. *Dual-use research of concern (DURC) is life science research that, based on current knowledge, can reasonably be anticipated to provide knowledge, information, products, or technologies that could be directly misapplied and pose a significant threat with broad potential consequences to public health and safety, crops and other plants, animals, the environment, material, or national security.*[10] *3.A) Were you familiar with this term/definition?*

4. *Intangible technology transfer (ITT) involves transferring or making controlled elements available to an entity or individual through intangible means, such as email, verbal communication, training, or visual inspection.*[11] *Did you know this term/definition? What is your opinion on this?*

5. *A) Do you know if there is education on the above topics? If yes, please provide details. [Responsible conduct of research]*

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10 Dual-use research of concern can be defined as "*research that is conducted for peaceful and beneficial purposes but could easily be misapplied to cause harm with no, or only minor, modification. This term has generally been used for research in the life sciences. DURC encompasses everything from information to specific products that have the potential to create negative consequences for the health of humans, nonhuman animals, plants and agriculture, and the environment*." See World Health Organization, "Global Guidance Framework for the Responsible Use of the Life Sciences: Mitigating Biorisks and Governing Dual-Use Research," Geneva, 2022, ISBN 978-92-4-005610-79l (electronic), <https://www.who.int/publications/i/item/9789240056107>.

11 Intangible technology transfer (ITT) involves transferring or making controlled items available to an entity or individual via intangible means, such as email, verbal communication, training, or visual inspection. See Hyuk Kim, "Intangible Transfer of Technology (ITT): Open-source Information Analysis for the Implementation of Sanctions on North Korea," James Martin Center for Nonproliferation Studies, March 14, 2023, <https://nonproliferation.org/intangible-transfer-of-technology-itt-open-source-information-analysis-for-the-implementation-of-sanctions-on-north-korea/>.

B) Do you know if there is training on the above topics? If yes, please provide details. [Dual-use]

C) Do you know if there is education on the above topics? If yes, please provide details. [Dual-use Research of Concern (DURC)].

D) Do you know if there is education on the above topics? If yes, please provide details. [Intangible technology transfer]

6. *Do you have any suggestions on the possibility of education on the abovementioned topics? Please share your ideas.*

In addition, an OSINT search about bioethics and other relevant committees was performed to ascertain the feasibility of utilizing those entities as foundations for the later inclusion of these concepts. Details about the courses developed in the context of the Chemical Weapons Convention were included as well as other personal initiatives related to DURC at the universities.

Results

After an OSINT search about STEM degree programs in Argentina, the authors decided to base their research on analyzing the official national website, called "Guía de Carreras," which includes all the current available career options in Argentina.[12]

To assess solely the STEM degrees in Argentina, the authors adhered to the criteria outlined in Table 1:

Table 1: Criteria used to conduct OSINT research - types of degrees considered STEM.

Criteria		
Resource:	https://guiadecarreras.siu.edu.ar/carreras_de_pregrado_y_grado.php	
Criteria Considered:	*Modality*	Classroom (in person) and Distance Learning
	State/Private	All
	Institution	All
	Province	All

12 Guía de Carreras Universitarias, Departamento de Información Universitaria, Secretaría de Políticas Universitarias, <https://guiadecarreras.siu.edu.ar/carreras_de_pregrado_y_grado.php>.

Type of Careers:	*Applied Sciences*	Astronomy
		Biochemistry and Pharmacy
		Agricultural Sciences
		Soil Science
		Statistics
		Industries
		Informatics
		Engineering
		Meteorology
	Basic Sciences	Biology
		Physics
		Mathematics
		Chemistry
	Health Sciences	Medicine

Note: *If the university offers a degree program in both virtual and in-person formats, it is considered as one distinct career in the tables.*

The online search was reduced to the analysis of a website. The authors analyzed more than 4,000 results showing that Argentina currently has 115 different universities with at least one STEM career. The Table with the list of universities can be found in Annex 2. The authors then proceeded to research the number of universities that teach each STEM degree program founded in Argentina. The results are shown in Annex 3. Annex 4 shows the number of STEM degrees per university.

The universities usually have different committees devoted to ethics, bioethics, research security, hygiene and security, or intellectual property. The committees that already have a structure in place can be used as a starting point to address the concepts of dual-use, responsible science, WMD nonproliferation, and intangible transfers discussed in this article.

There are several types of degree programs at universities in Argentina that are summarized (without any specific order) in *Table 2*.

Table 2. Types of university degree programs in Argentina

Type of Degree
Grado (Undergraduate Degree)
Otros Pregrados (Other Undergraduate Degrees)
Técnico Instrumental (Instrumental Technician)
Título Intermedio (Intermediate Degree)

Ciclo de Complementación (Curricular Complementation Cycle)
Ciclo de Licenciatura (Bachelor's Degree Cycle)
Ciclo Básico Común (Common Basic Cycle)
Postítulo (Postgraduate Degree)
Ciclo de Profesorado (Teacher Training Cycle)

This information allows for the determination of the following:

- How many STEM universities exist;
- The type of courses/degrees;
- How many STEM degrees exist per university;
- Ethics bodies per university.

Argentina has made some progress on the ethical side of biosecurity issues. For example, The National Committee of Ethics in Science and Technology was created in April 2001 according to Resolution 004/2001 and its guidelines were confirmed by Resolutions 031/2002 and 600/2004. The CECTE belongs to the Ministry of Science and Technology and is the Argentinean reference organization for topics related to ethics in science and technology. Members of the CECTE have actively participated in different international organizations where "ethics in science" was a subject of discussion (such as COMEST).[13]

In this context, the Argentine Physical Society has a Code of Ethics that requires scientists to accept their responsibilities while carrying out their functions as researchers and in the management of the resources for scientific research and to acknowledge the existence of possible conflicts of interest while in charge of these tasks.[14]

At the University of Cordoba, activities take place that are "...encouraged by the initiatives of the Organization for the Prohibition of Chemical Weapons on education about the prevention of illicit purposes of chemistry" and in this context there is a

> *"one-day workshop, called the Itinerant Lecture, that covers theoretical aspects combined with activities to promote critical thinking among students. The main topics are presented in an engaging way that is open to discussion and includes activities such as fictional case analyses and role-playing, which allow students to consider the problematic aspects of their roles as scientists. This workshop has been running for the last five years, with apparently very high acceptance by students and teachers in the chemistry field. The use of videos, role-playing, and an active-learning strategy for the topics becomes an excellent approach to introduce chemistry students and teachers to concepts such as professional responsibility and dual-use of knowledge in the sciences and their implications in the production of*

13 Bioweapons Monitor, 2014, <https://www.bwpp.org/documents/BWM%202014%20WEB.pdf>.

14 "Code of Ethics: Ethical Standards of the Physical Society of Argentina," Physical Society of Argentina, Virtual Biosecurity Center, March 30, 2011, <http://www.fisica.org.ar/?page_id=104>.

chemical weapons and other illegal uses…"[15]

The authors' survey was answered by 29 individuals, anonymously. The objective was to have experts/professionals who work not only in science but also in the export control system. The first two questions were about their work area and profession, and the results are:

Work Area / Profession	Number of Answers
Chemistry	2
Biology/Microbiology	9
Biochemistry/Pharmacy/Genetics	6
Computer Sciences	1
Political Sciences	1
Engineering / material sciences	3
International relations	2
Agronomy	1
Physics	2
Medicine	1
Veterinary	1
Total	**29**

Job titles and roles are:

Job Title / Role	Number of answers
Researcher/Faculty	17
Scientist	3
Public Sector Employee	3
Diplomat	1
Politologist	1
Veterinarian	2
Others (consultant/advisors)	1
Military	1
Total	**29**

Next, the survey questions and the most relevant answers were listed to understand the thinking of the respondents regarding the topics. An analysis of the answers will be presented in the

15 Integrating Chemical Security into Chemistry Degree Programs in Argentina through an Interactive One-Day Course Addressing Illicit or Harmful Applications of Chemistry Knowledge. https://pubs.acs.org/doi/10.1021/acs.jchemed.9b00799

Discussion section of this paper.

1. 1. A)Responsible conduct of research (RCR) is defined as "the practice of scientific research with integrity." It involves the knowledge and application of established professional standards and ethical principles in the performance of all activities related to scientific research.

Did you know this term/definition?	Number of answers
No	20
Yes	9
Total	**29**

1.B. What is your opinion about this?

All the exact answers to the survey can be found in **Annex 5.** It is interesting to highlight that even when most of the respondents declare that they do not know the definition proposed, they still understand the concept and its implications for the academic community. Also, many agreed that they were educated to work responsibly but clearly there is a lack of formal education.

2. In politics, diplomacy, science and technology, and export control, dual-use items refer to goods, software, and technology that can be used for both civilian and military applications (or that have both beneficial and malign uses). More broadly, dual-use can also refer to any good or technology that can satisfy more than one purpose at any given time. What is your opinion on this?

Were you familiar with this term/ definition?	Number of answers
No	8
Yes	21
Total	**29**

3. 3.A) Dual-use research of concern (DURC) is life science research that, based on current knowledge, can reasonably be anticipated to provide knowledge, information, products, or technologies that could be directly misapplied and pose a significant threat with broad potential consequences to public health and safety, crops and other plants, animals, the environment, material, or national security.

Were you familiar with this term/ definition?	Number of answers
No	21
Yes	8

Total	**29**

3.B) What is your opinion about this?

All the exact answers are shown in **Annex 6** but generally the replies were similar to those for question 1A. Some of the respondents showed a clear preference for having a top-down approach with different institutions providing guidance and training to have a structured, coordinated approach and less personal initiatives that depend on individuals and not on organizations.

4. 4.A) Intangible technology transfer (ITT) involves transferring or making controlled elements available to an entity or individual through intangible means, such as email, verbal communication, training, or visual inspection.

Did you know this term/definition?	**Number of answers**
No	22
Yes	7
Total	**29**

4.B) What is your opinion about this?

All the exact answers are shown in **Annex 7**, and as in previous open questions, the respondents have a lack of knowledge or understanding of the meaning and implications of this term. This is one of the most complicated topics, since the Web is considered a tool to facilitate research and not a means to negatively affect the work.

5. 5.A) Do you know if there is education on the above topics? If yes, please provide details. [Responsible conduct of research]

No	8
Yes	14
I don't know	7
Total	**29**

5. B) Do you know if there is training on the above topics? If yes, please provide details. [Dual-use]

No	12
Yes	12
I don't know	5

Total	**29**

5. C) Do you know if there is education on the above topics? If yes, please provide details. [Dual-use Research of Concern (DURC)].

No	15
Yes	4
I don't know	10
Total	**29**

5. D) Do you know if there is education on the above topics? If yes, please provide details. [Intangible technology transfer]

No	13
yes	8
I don't know	8
Total	**29**

6. Do you have any suggestions on the possibility of education on the abovementioned topics? Please share your ideas.

The exact answers to these questions are shown in **Annex 8**. In summary, the respondents want to know more about dual-use and the other topics included in this survey and to implement different educational strategies to have not only students but also graduates and researchers aware of these concepts.

Discussion

To understand the current situation in Argentina, the authors' starting point was to consider the legal scaffolding in terms of export control of dual-use goods and other nonproliferation initiatives. The analysis shows that Argentina is the only country in the region that is engaged in all relevant export control regimes, agreements, treaties, and other initiatives, such as the Proliferation Security Initiative (PSI) and Container Security Initiative (CSI). The international commitments and national enforcement structure provide the umbrella to go deeper in the work with universities to implement the strongest ITT controls.

The research conducted for this article can support the government's formation and strengthening of its ITT policy. The survey and discussions with experts in the area shows that there are gaps regarding intangible transfers, particularly for universities and research centers. However, most of the survey respondents showed a positive attitude towards working together to implement university education in ITT and responsible use of sciences. This openness is an incentive to look for opportunities to help add these new concepts into their courses (formally

or informally), add new courses, or create special activities to discuss them. Over the past few years, the concept of responsible conduct of research has become a synonym for performing research following nonproliferation principles, being aware of the dual-use or potential misuse of research results, as well as acknowledgment of the vulnerabilities that arise from cyberspace. The respondents to the survey were mostly not aware of the term and many considered it related to ethical behavior. Nevertheless, many consider respondents replied that when they work, they do follow these parameters even when there is potential confusion about the terms, highlighting the importance of showing interest. This situation demonstrates the value of formal education on responsible science and ITT, as it would create coherence between the legal frameworks and what experts do and why. It would also provide formal guidance on how to perform their work safely and securely and encourage compliance. The lack of knowledge about the existence of certain concepts is a key insight of this research.

It is interesting to note that most of the respondents declared to be familiar with the term dual-use but were nevertheless aware of its definition. However, respondents are supportive of understanding the potential negative impacts of research, even when considering this a difficult task due to the related unpredictability of the research and innovation.

ITT is again a term not well known by the respondents, considering that they would like to know more. Some consider that due to how research takes place and the role of virtuality and the future of AI developments, it would be difficult to implement any sort of control.

When asked about their knowledge of education on the mentioned topics, the majority responded that they do not know or that there is no education on them. Those who answered yes did not provide much info, except that:

- At The National Technological University (UTN) there is a Sensitive Technologies Network (RITS) that deals with dual-use technologies and scientific research (nuclear, space, cybersecurity).

- In Argentina, the CIME course (Training in the Identification of Strategic Goods) has been implemented, which provides instruction on existing strategic export controls and the international commitments assumed by the country in the matter and is training for the recognition of goods that could contribute to the development of WMD.[16,17]

In this context, the chemical weapons and dual-use course delivered at the University of Cordoba is attended by several students from different universities. Its modality makes it more accessible for all to attend. Even when this is a top-down initiative, professors work to pass their knowledge to students, constantly communicate with the ANCAQ, and inform the OPCW.

In other cases, some professors decide to discuss the topics of responsible science, dual-use and nonproliferation with their students on their own initiative. This demonstrates the interest of some members of the academic community to raise awareness about these topics. The authors consider that further research is necessary to identify these initiatives and how they can be strengthened.

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16 "El Ministerio de Defensa llevó Adelante una Nueva Jornada del Taller de Capacitación Para la Identificación de Mercaderías Estratégicas," Argentina Ministry of Defense, July 4, 2023, <https://www.argentina.gob.ar/noticias/el-ministerio-de-defensa-llevo-adelante-una-nueva-jornada-del-taller-de-capacitacion-para>.

17 This course's attendance includes Customs and military and security personnel.

The survey respondents strongly supported the implementation of courses with different formats to cover the topics mentioned, both at the undergraduate and graduate levels. Having workshops is another possibility together with creating MOOCs. It also highlighted the importance of having a multidisciplinary approach, which will be a mirror of how nonproliferation and export control are enforced.

Conclusion

The research conducted by the authors showed an incipient understanding of the concepts of dual-use, responsible research, and ITT as well as a clear interest in improving this level of understanding through educating scientists and researchers. The survey also confirmed the gap in formal education on the topics mentioned above, but surprisingly, the respondents were open not only to knowing more but also to contributing to the development of courses and materials to increase the competencies of students and researchers. The research findings have enabled the identification of educators responsible for delivering lectures or courses on the subject and opens pathways for increasing networking and collaboration with these trainers.

Recognizing the identified need from the research, there is a plan to develop a series of modules addressing these topics, incorporating the expertise of international experts and programs. Notably, there are existing initiatives worldwide focusing on CBRN nonproliferation and export control education, and efforts are underway to bring this valuable knowledge to Argentina. The modules will be developed in such a way that they can be used in other Latin American countries to improve overall capacity in the region. Upon the creation of the modules, a train-the-trainer course will be established for professors interested in delivering them. This creates a cycle for maintaining these efforts. Additionally, there is a strategy to approach university authorities for a more structured implementation of these modules within the academic framework. Engaging relevant stakeholders, including CONCESYMB, is deemed essential, and the plan includes informing them about the research results, as well as updating them on the subsequent steps and progress.

Annex

Annex 1: Policies and Agreements on Biological and Toxin, Chemical, and Nuclear Weapons in Argentina

Policies/ Initiatives/ Agreements	Date	Summary	Source
Biological			
The Declaration of Mendoza	Was signed in 1991 by Argentina, Brazil, and Chile. Later, it opened to most Latin American countries, and four signed the Declaration: Bolivia, Ecuador, Paraguay, and Uruguay.	Its parties will not use, develop, produce, acquire, stockpile, retain, or transfer, directly or indirectly, chemical or biological weapons.	Link
Biological Weapons Convention (BWC)	It is a state party of the Biological and Toxin Weapons Convention (BWC), having ratified it in November 1979	The Biological Weapons Convention (BWC) effectively prohibits the development, production, acquisition, transfer, stockpiling, and use of biological and toxin weapons. It was the first multilateral disarmament treaty banning an entire category of weapons of mass destruction (WMD).	Link
The Geneva Protocol	Argentina acceded to the Geneva Protocol on May 12, 1969	Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare	Link
Australia Group	Argentina joined in 1993.	The Australia Group is an informal forum of countries that, through the harmonization of export controls, seeks to ensure that exports do not contribute to the development of chemical or biological weapons.	Link

Nuclear			
Treaty on the Nonproliferation of Nuclear Weapons (NPT)	On February 10, 1995, in Washington, Argentina acceded to the Nonproliferation Treaty as a non-nuclear weapon state.	International treaty whose objective is to prevent the spread of nuclear weapons and weapons technology, to promote cooperation in the peaceful uses of nuclear energy, and to further the goal of achieving nuclear disarmament and general and complete disarmament.	Link
"International Partnership for Nuclear Disarmament Verification" (IPNDV)	Argentina joined the initiative.	The country reaffirms its commitment to the nonproliferation of nuclear weapons and its efforts to advance toward complete nuclear disarmament in a verifiable, transparent, and irreversible way.	Link
Agency for Accounting and Control of Nuclear Materials (ABACC)	In the early 1990s, Argentina and Brazil, established a bilateral inspection agency (ABACC). In 1991 the National Congresses of Argentina and Brazil ratified the bilateral agreement.	The Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) was created to verify both countries' pledges to use nuclear energy only for peaceful purposes and signed the Quadripartite Agreement with the International Atomic Energy Agency (IAEA).	Link
Latin America Nuclear Weapons Free Zone Treaty (Treaty of Tlatelolco)	Argentina opened for signature the 27 September 1967 and on January 18, 1994, for Ratification	The Treaty of Tlatelolco established a nuclear-weapon-free zone in Latin America	Link

The NSG (Nuclear Suppliers Group)	Argentina joined in 1994	The Nuclear Suppliers Group (NSG) is a group of nuclear supplier countries that seeks to contribute to the nonproliferation of nuclear weapons through the implementation of two sets of Guidelines for nuclear exports and nuclear-related exports.	Link
"International Partnership for Nuclear Disarmament Verification" (IPNDV)	Argentina joined in 2015, reaffirming its commitment to nuclear nonproliferation.	The IPNDV brings together more than 30 states with and without nuclear weapons under a cooperative framework to promote further understanding of the complex challenges involved in the verification of nuclear disarmament and to identify potential solutions to overcome those challenges.	Link
Chemical			
Chemical Weapons Convention (CWC)	Ratifying the Chemical Weapons Convention on October 2, 1995.	The Convention on the Prohibition of the Development, Production, Stockpiling, and Use of Chemical Weapons and their Destruction.	Link
The Declaration of Mendoza	Signed in 1991 by Argentina, Brazil, and Chile. Later opened to most Latin American countries, and four signed the Declaration: Bolivia, Ecuador, Paraguay, and Uruguay.	Its parties will not use, develop, produce, acquire, stockpile, retain, or transfer, directly or indirectly, chemical or biological weapons.	Link
The Geneva Protocol	Argentina acceded to the Geneva Protocol on May 12, 1969	Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare	Link

Australia Group	Argentina joined in 1993.	The Australia Group is an informal forum of countries that, through the harmonization of export controls, seeks to ensure that exports do not contribute to the development of chemical or biological weapons.	Link
General WMD			
Political Declaration of MERCOSUR.	Argentina, Bolivia, and Chile signed a zone of peace in Ushuaia on the 29th of July 1998.	The Southern Common Market Market (MERCUSOR), of which Argentina is a member, declared its geographic region and Bolivia and Chile free of weapons of mass destruction (WMD) and a "zone of peace" in July 1998 through the Declaration of MERCOSUR, signed in Ushuaia, Argentina.	Link
MTCR (Missile Technology Control Regime)	Argentina also joined the MTCR in 1993.	The Missile Technology Control Regime (MTCR) is an informal political understanding among states that seeks to limit the proliferation of missiles and missile technology.	Link Link
Security Council Resolution 1540	Argentina firmly and vigorously supports the terms of the resolution 1540.	In resolution 1540 (2004), the Security Council decided that all States shall refrain from providing any form of support to non-state actors that attempt to develop, acquire, manufacture, possess, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery, in particular for terrorist purposes.	Link

Annex 2: Complete List of Universities with STEM Careers:

University
Universidad de Buenos Aires
Universidad Nacional de Córdoba
Universidad Nacional de La Plata
Universidad Nacional de Tucumán
Universidad Nacional del Litoral
Universidad Nacional de Salta
Universidad Nacional de San Luis
Universidad Nacional de Cuyo
Universidad Nacional del Sur
Universidad Nacional de Rosario
Universidad Nacional de San Juan
Universidad Nacional de Mar del Plata
Universidad Nacional del Comahue
Universidad Nacional de Misiones
Universidad Nacional del Nordeste
Universidad Nacional de Santiago del Estero
Universidad Nacional de Catamarca
Universidad Nacional de la Patagonia San Juan Bosco
Universidad Nacional de Entre Ríos
Universidad Nacional de Río Negro
Universidad Nacional del Centro de la Provincia de Buenos Aires
Universidad Nacional del Chaco Austral
Universidad Nacional de La Pampa
Pontificia Universidad Católica Argentina Santa María de los Buenos Aires
Universidad de Morón
Universidad Nacional de La Rioja
Universidad Autónoma de Entre Ríos
Universidad Nacional de Río Cuarto
Universidad Juan Agustín Maza
Universidad Nacional de Jujuy
Universidad Nacional de Formosa
Universidad Católica de Córdoba
Universidad de Belgrano
Universidad Nacional de General Sarmiento
Universidad del Norte Santo Tomás de Aquino
Universidad Nacional de Luján
Universidad Empresarial Siglo 21
Universidad Tecnológica Nacional
Universidad Nacional Arturo Jauretche
Universidad Nacional de San Martín

Universidad Católica de Salta
Universidad Nacional de Villa María
Universidad Nacional de Hurlingham
Universidad Nacional de La Matanza
Universidad Nacional de la Patagonia Austral
Universidad Católica de Santiago del Estero
Universidad Argentina de la Empresa
Universidad Nacional del Noroeste de la Provincia de Buenos Aires
Universidad Nacional de Chilecito
Universidad Católica de Santa Fe
Universidad Austral
Universidad Nacional de San Antonio de Areco
Universidad de la Defensa Nacional
Universidad Nacional de Tres de Febrero
Universidad CAECE
Universidad Nacional de Villa Mercedes
Universidad Nacional de Lomas de Zamora
Universidad de la Fraternidad de Agrupaciones Santo Tomás de Aquino
Universidad Nacional de Quilmes
Universidad Nacional de Rafaela
Universidad Católica de Cuyo
Universidad Provincial del Sudoeste
Universidad Nacional del Oeste
Universidad Maimónides
Universidad Argentina John F. Kennedy
Universidad Nacional Guillermo Brown
Universidad del Aconcagua
Universidad Nacional de Tierra del Fuego, Antártida e Islas del Atlántico Sur
Universidad Blas Pascal
Universidad Nacional de Avellaneda
Universidad Nacional de Lanús
Universidad de la Marina Mercante
Universidad Nacional de los Comechingones
Universidad Pedagógica Nacional
Universidad Favaloro
Universidad de Mendoza
Universidad del Gran Rosario
Universidad del Chubut
Instituto Universitario Escuela de Medicina del Hospital Italiano
Instituto Universitario de Ciencias Biomédicas de Córdoba
Universidad del Centro Educativo Latinoamericano
Universidad Católica de La Plata
Universidad de Palermo

Universidad de Concepción del Uruguay
Universidad del Salvador
Universidad Metropolitana para la Educación y el Trabajo
Universidad Nacional José C. Paz
Instituto Tecnológico de Buenos Aires
Universidad de Ciencias Empresariales y Sociales
Universidad de Flores
Universidad Abierta Interamericana
Universidad Nacional de Moreno
Universidad de la Cuenca del Plata
Universidad Atlántida Argentina
Instituto Universitario de Seguridad Marítima
Universidad Provincial de Ezeiza
Universidad Adventista del Plata
Universidad de San Pablo - T
Universidad Nacional del Alto Uruguay
Universidad Gastón Dachary
Instituto Universitario de Ciencias de la Salud de la Fundación Barceló
Universidad Torcuato Di Tella
Universidad Champagnat
Instituto Universitario para el Desarrollo Productivo y Tecnológico Empresarial de la Argentina
Universidad Católica de las Misiones
Instituto Universitario CEMIC
Universidad Nacional Raúl Scalabrini Ortiz
Universidad del Este
Universidad Provincial de Córdoba
Universidad del CEMA
Universidad de Congreso
Instituto Universitario Escuela Argentina de Negocios
Universidad de San Andrés
Instituto Universitario Italiano de Rosario
Instituto Universitario de Gendarmería Nacional

Annex 3: Number of Universities Covering STEM Degree Programs

STEM Degree	Count of universities that teach each career
Médico (Physician)	45
Ingeniero Industrial (Industrial Engineer)	42
Ingeniero Agrónomo (Agricultural engineer)	32
Ingeniero en Informática (Informatics Engineer)	27
Ingeniero Químico (Chemical engineer)	25
Ingeniero Electrónico (Electronic Engineer)	25

Ingeniero Civil (Civil engineer)	22
Farmacéutico (Pharmacist)	20
Ingeniero en Alimentos (Food engineer)	20
Bioquímico (Biochemist)	20
Ingeniero Mecánico (Mechanical engineer)	19
Ingeniero Electromecánico (Electromechanical engineer)	18
Profesor en Matemática (Mathematics professor)	18
Licenciado en Ciencias Biológicas (Degree in life sciences)	17
Licenciado en Matemática (Degree in Mathematics)	17
Profesor en Física (Professor in Physics)	15
Profesor en Química (Chemistry Professor)	15
Licenciado en Química (Degree in Chemistry)	14
Ingeniero Agrimensor (Surveying Engineer)	13
Licenciado en Gestión Ambiental (Degree in Environmental Management)	13
Licenciado en Sistemas (Degree on Systems)	12
Licenciado en Sistemas de Información (Degree on Information Systems)	12
Licenciado en Biotecnología (Degree in Biotechnology)	12
Licenciado en Física (Degree in physics)	12
Ingeniero en Telecomunicaciones (Telecommunications Engineer)	11
Profesor en Ciencias Biológicas (Professor in Biological Sciences)	11
Analista de Sistemas (Systems analyst)	10
Licenciado en Informática (Degree in computer science)	10
Ingeniero Ambiental (Environmental engineer)	10

Annex 4: Number of STEM Careers per University

Universidad Nacional de La Plata	55
Universidad de Buenos Aires	50
Universidad Nacional del Litoral	50
Universidad Nacional de San Luis	46
Universidad Nacional del Sur	42
Universidad Nacional de Córdoba	41
Universidad Nacional de Rosario	37
Universidad Nacional de Cuyo	36
Universidad Nacional del Centro de la Provincia de Buenos Aires	36

Universidad Nacional del Comahue	35
Universidad Nacional de San Juan	35
Universidad Nacional del Nordeste	34
Universidad Nacional de Catamarca	34
Universidad Nacional de Tucumán	33
Universidad Nacional de Misiones	32
Universidad Nacional de Salta	32
Universidad Nacional de Santiago del Estero	31
Universidad Nacional de la Patagonia San Juan Bosco	30
Universidad de Morón	29
Universidad Nacional de Río Negro	28
Universidad Nacional de Mar del Plata	26
Universidad Nacional de La Rioja	26
Pontificia Universidad Católica Argentina Santa María de los Buenos Aires	26
Universidad Nacional de Entre Ríos	24
Universidad Autónoma de Entre Ríos	22
Universidad Nacional de Río Cuarto	20
Universidad Nacional de La Pampa	18
Universidad Nacional del Chaco Austral	15
Universidad Juan Agustín Maza	11

Annex 5: Responses to Survey Question: Responsible Conduct of Research

Responsible conduct of research (RCR) is defined as "the practice of scientific research with integrity". It involves the knowledge and application of established professional standards and ethical principles in the performance of all activities related to scientific research. 1A) What is your opinion about this? Intangible technology transfer (ITT) involves transferring or making controlled elements available to an entity or individual through intangible means, such as email, verbal communication, training, or visual inspection. What is your opinion?

I didn't know those concepts. They are only addressed in the academy, very tangentially and always in good faith, ignoring bad or illegal uses.
Yes, I knew the concept. I consider that RCR is something that should be included in the curricula of different careers as spaces that give rise to reflection, on the analysis of the social scope of the discipline itself in different scenarios of professional conduct concerning research activities.

I didn't know it, but it is almost obvious that any investigation should be carried out honestly, without cherry-picking data and getting the answers that emerge, not the ones you want.
No. I think it is extremely important to talk about this.
I knew the concept, although not the textual definition. I believe that it is a fundamental basis on which we should perform as scientists.
I had heard it. I think it is necessary to advance clear rules/responsibilities like doctors or architects have.
No, it is important to spread it.
I didn't know it as such, but I did know the concept of good research practices. They must be framed within the scope of scientific research and protected by aesthetic standards.
I did not know this term, however, I apply the concept in my work area
I don't know it as such, but I practice it daily, working in health involves adhering to the rules, applying the principles of ethics, but mainly a high degree of empathy and respect is required for those who need our service.
I did not know the term exactly, but they have trained me since my graduation, instilling in me ethical and responsible conduct for the performance of my professional duties.
I did not know this term, but that of responsible research and the code of public ethics, which make one as a researcher use the funds received exclusively for what they were given. I think it is good to include integrity in the definition since it is comprehensive, but the scientific population should be educated about it.
No, I find it interesting, as long as it is not a way of restricting diversity and only lowering the line of one way of doing things (research)
I didn't know the term, although I did know the practice. Interesting
Yeah. It is very good but although it is tacitly recognized, I do not think it is put into practice.
I did not know that term and it is good that before carrying out research work it is approved, in my case by the Luis Pasteur Zoonoses Institute, all research work must be approved by the CEI (ethics and research committee).
I didn't know the term, but in my practice, I try to be governed by this same principle of integrity.
Yes. It is a topic in which not only the researcher but also the institution where the research is carried out must be committed. Transparency must be achieved in the work carried out by researchers.
Yes, I knew her, and I agree.
If you knew similar expressions. In my area of expertise it is called bioethics
Yes, I knew it. It is essential i) to have ethical standards, ii) that they are widely disseminated, iii) that these principles be discussed as a way of reflecting on the topic, iv) Transmit and teach these concepts in the classroom and when working with students.
I didn't know it. I consider it essential for the development of science in any field.
Yes, I know the definition, and I think that dissemination and awareness about this is of utmost importance.

I didn't know it but it seems like a correct definition to me. I would add that these activities must have a justified purpose, a clear hypothesis, and an adequate development.
I did not know the term but I did know the concept, it is how I have managed to carry out research during my doctorate.
I didn't know the term. Courses on ethical performance standards and principles are not usually offered in my areas of performance.

Annex 6: Responses to Survey Question: Dual-Use Research of Concern

Dual-use research of concern (DURC) is life science research that, based on current knowledge, can reasonably be anticipated to provide knowledge, information, products, or technologies that could be directly misapplied and pose a significant threat with broad potential consequences to public health and safety, crops and other plants, animals, the environment, material, or national security. What is your opinion?

I did not know it was defined that way, but it is generally taught in Ethics and legislation in biotechnology
I did not know the term as such, but I did know the concept that when doing research, even if not all possibilities can be foreseen, it is vital to start thinking about what can go wrong, so as in the previous question, try to look for actions that can prevent/reverse/mitigate Negative effects.
Yeah. I consider it dangerous and ethically reprehensible.
If some technology is very easy to take to fields where it can cause harm, its use must be controlled. But the opportunity should not be lost to the benefits that can be achieved
No. I find it interesting to learn more about the subject. It seems essential to me to advance with this line of research
Related to the previous question. I think this topic should be discussed more.
I knew the definition. Professional guidelines/responsibilities must be established as with some professions
Not without knowledge of the term
I didn't know. It would be necessary to analyze what makes something dangerous. Let's think about a simple knife, the use we give it is what makes it such. Just today they killed a person with a Tramontina. Whoever manufactured it did not violate any ethics. This indirectly brings me to Napoleon... Bayonets are useful for anything except sitting on top
I do not know that terminology, however, each professional must know the scope and potential uses of their products, therefore they must take precautions for their proper use.
I know the term but again I believe that my environment does not know it and this is worrying since it is necessary to become aware of the danger of the incorrect use of knowledge, information, products and/or technologies, even more so that mental illnesses are becoming more frequent in people. people.

I did not know this term, I have been away from areas of biological research for more than 6 years. I think, like the previous answer, we must focus on the control bodies so that with state policies, regulations and measures, scientific research is not stopped due to a possible problem that may or may not develop for certain. The education of researchers is key, it is the first tool that gives us guarantees of their work, but a good supervision system helps avoid "detours in research"
I didn't know it, and he seems very good to me.
I didn't know it. Although in many fields it is difficult to predict consequences (thalidomide...) having a method can be useful
I do not know that term, and I believe that in each case the purposes of the research must be established with approved protocols and the objectives of said project clear, and the conditions of biosafety and consent if required.
I didn't know the term. It is essential to categorize these goods as dual and for this this type of research is required.
Yes. Awareness of the risks that exist due to dual-use must be created, especially in the research area so that scientists keep this concept in mind when discovering or developing new technologies.
I didn't know about it (I would translate it as Concern about Dual-use of Research). It is essential to take this into account and make it known.
Yes, I know it, although it falls outside my scope of professional responsibility.
I didn't know it. It should be spread more in non-specialized areas.
I didn't know it. I believe that it is difficult to prevent this research from occurring and eventually being used for harmful purposes.
I didn't know the term. It is a more precise definition than "dual-use."

Annex 7: Responses to Survey Question: Intangible Technology Transfer

Intangible technology transfer (ITT) involves transferring or making controlled elements available to an entity or individual through intangible means, such as email, verbal communication, training, or visual inspection. What is your opinion?

I think it would only be useful to be accompanied by inspections, otherwise the evasion, errors and falsification of information are not detected.
I was not aware of this term as such, but about confidentiality agreements that establish that any disclosure of information that is part of the agreement includes any means. In the case of verbal communications, I consider them to be the most difficult to prove that they occurred.
I did not know the term, but the use of intangibles, whether goods or services, is increasingly necessary.
No. I find it interesting to learn more about the subject.
I didn't know him. I think it is part of the consulting/technology transfer.
I know the term. More international elaboration required

I didn't know the term but I did know the concept. Regarding intangible transfer through emails, I believe that sometimes data vulnerability situations can arise.
Not as such, diagnostic methods and health technology are transferred through training frequently and are done within current regulations for their proper use.
I did not know this term, but in practice, I have done it, without becoming very aware of the act itself. In any case, there are situations in which this must be done mandatory by institutional provisions.
I know this topic well, it is today a big black hole. Since the researcher's career implies the preparation of papers, participation in conferences and the exchange of information with colleagues. If a researcher does not carry out these activities, he never grows professionally and that affects not only his academic career but also his pocketbook. Today this discussion is still open and the truth is that I do not see a quick solution. I think that as a basis we should have two qualification systems for scientists, one open and public and the other closed, but the issue is so broad that a very firm state policy is needed to carry it forward.
I didn't know about it and I find the possibility of being attentive to that vulnerability interesting.
Yeah. Care and regulations must be taken with the transfer of knowledge through these channels, and especially if they are for dual-use.
I didn't know that term, it is very difficult to control this information management nowadays.
Yes. It is a difficult area to control. All research works are found on the web; there is an exchange of personnel between the different institutes in different countries; Programs can be sent remotely or on small devices that go unnoticed by customs controls. It is a challenge for all countries.
I didn't know it. I think it should be controlled
I didn't know it. It's scary
Yes, they are procedures that must be paid attention to and that researchers should be aware of.
I learned it recently through a class given by a guest expert in the university environment. Again I suggest dissemination in directly or indirectly linked sectors.
Undoubtedly, the current ease of movement of information and people means that the transfer of knowledge and technology has a diffusion that is in some cases impossible to estimate.
I didn't know the term. I think it would be incorrect to use the word "elements" for the type of technology that can be transferred through the aforementioned means; "information" or "knowledge" would be more appropriate terms.

Annex 8: Responses to Survey Question: Education

Do you have any suggestions on the possibility of education on the abovementioned topics? Please share your ideas.

It is necessary to incorporate these concepts into the curriculum
Workshops, MOOC courses.

They could be incorporated into introductory subjects of stem careers and through scientific dissemination.
Most of these issues show how important it is for each individual to take responsibility for their consumption and actions.
I think it is very important to advance with the training of professionals but also among students in biology and related careers.
In the same way that careers such as medicine have legal subjects in their curricula, the same should occur in some engineering, biology, physics, etc.
It is important to implement biological-scientific careers in the curriculum at different educational levels.
Research ethics should be part of subjects such as research methodology
I believe that they are concepts and topics that should begin to be widely disseminated, both in postgraduate courses and in undergraduate subjects.
I imagine that there must be organizations that train on these topics, I don't know who or which ones.
Education in these topics should already begin at graduation and then should be reinforced in post-graduation.
Yes, specifically point 4, TIT is today, in my opinion, the big problem, and I find that decision makers always try to be "politically correct" then since the academic world is involved and public opinion is behind it, no one ever sits down to plan. alternatives in this regard to be able to ensure the information produced in our research centers. Be careful, I am not judging the researchers, this is an institutional and educational problem for each of the research centers.
There are several ideas and they would all be valid, I believe that first there must be a state policy that defines the guidelines and based on that, develops a plan.
I believe that whenever sensitive topics with dual abilities are being investigated, education should be generated about it.
These are fairly general topics of application, they should be part of a combined strategy. Presentation of the topic at conferences or meetings, notes in the media, etc.
At UTN there is a Sensitive Technologies Network (RITS) that deals with dual-use technologies and scientific research (nuclear, space, cybersecurity).
Each institution that handles this type of bioinformatic biological material must have these protocols and make them known to the staff, and not find out that they exist when one wants to carry out research.
It would be interesting to incorporate this approach during undergraduate courses, although I recognize that it would require a subject designed with a view related to the current of science, technology and society. With a much smaller scope, it would be possible to carry out postgraduate courses in this regard, thinking about them applied in a particular field to generate the interest of experts in different specific areas.

In our country, the CIME course (Training in the Identification of Strategic Goods) has been implemented, which provides instruction on the existing strategic export controls and the international commitments assumed by the country in the matter, and is training for the recognition of goods that could contribute to the development of nuclear, biological and chemical weapons, or their delivery systems, such as missiles and rockets. Also, this year, training in intangible technology transfer was received from the United States and a workshop was held with Brazil.
I consider that they are important topics to be incorporated into the curricula of the corresponding careers.
General and professional ethics must occupy more space in the training and management of science
My previous answer is focused on my university, I don't know what it is like at others, although I have the impression that education on these topics is not very widespread and is necessary.
Linkage between specialists in these fields with students and educational settings. Seminars and dissemination tasks in sectors such as diplomacy, intelligence, armed forces and security. Possibility of participation in seminars/scholarships for university students and teachers to generate a multiplier effect in the dissemination of this type of knowledge and work on it from a multidimensional approach.
The issue of education about scientific research is not seen in undergraduate courses (or it was not seen when I was studying a few years ago). I received this
It does not begin to be seen in master's or postgraduate courses and empirically when one begins to actively participate in this type of activities and begins to question methodologies and results from reading papers and publications.
They seem very specific terms to think about an education that involves a subject in undergraduate courses. Perhaps it should be considered as knowledge to be taught transversally in various subjects. Mandatory virtual courses can be implemented for teachers, researchers and/or professionals who work on projects with possible DURC (from public institutions at least), similar to those taught within the framework of the Yolanda law, for example.

Strategic Trade Control of Transshipments: Know Your Customer-Based Best Practices for Counterproliferation

KUSHANI DE SILVA AND ROHAN PERERA[1]

Abstract

International regulations play a crucial role in enhancing understanding of counterproliferation strategies in the context of maritime security. Thus study identifies Know Your Customer (KYC)-based sanction-sound best practices in transshipment, which are essential for effectively countering proliferation and also valuable in reducing smuggling trends by enhancing end-user screening processes. Best practices have been identified through a study where data was gathered through a questionnaire completed by 30 experts from Bangladesh, China, Iraq, India, Indonesia, Jordan, Malaysia, Pakistan, Philippines, and Sri Lanka. Additionally, five experts provided insights on cross-border customs compliance and maritime security concerns. It was found that KYC-based best practices and red flag indicators are essential for identifying the final recipient or purpose of sensitive goods or dual-use goods/technologies and that national

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licensing authorities should publish and regularly update lists of red flags, taking into account research, case reports, incidents, and emerging threats. They should also manage the risks associated with sensitive technologies, such as the cyber security of Internal Compliance Programs (ICPs).

Keywords

Know-Your-Customer, strategic trade controls, sanctions, transshipment, counterproliferation

Introduction

Maritime import-export operations have become essential in supply chains, particularly in transshipment operations. These operations involve sophisticated tactics using vessels that can be misused in ways such as the use of disinformation to submit legitimate documents, misuse of automatic identification systems for ship-to-ship transfers, and non-compliance with corporate management systems to confuse vessel ownership.

Internal Compliance Programs (ICPs) play a crucial role in transshipment. ICPs serve as a monitoring tool to prevent the transfer of strategic goods to prohibited end-users or end-uses. They are an in-house manual that consists of Standard Operating Procedures (SOPs) and internal protocols that enable the identification of emerging risks and efficiently manage them using export control-related risk reduction strategies.[21]It is important for companies to conduct self-audits, taking voluntary disclosure and incident reports into consideration. These audits help ensure that the company is gathering and analyzing information accurately with the help of capable experts. Additionally, software automation is essential for ensuring the security of delivery and efficiency of processes when dealing with largevolumes of diverse export control regulations across the globe.

Examples of useful software include risk assessment, compliance screening, export controls, and license management software. Non-compliance with the ICP can result in financial penalties, legal repercussions, reputational damage, and socio-economic and environmental losses.

The main objective of this article is to investigate and present best practices related to Know-Your-Customer (KYC)-based, sanctions compliant, and resilient strategic trade control of transshipment for countering proliferation. The best practices presented have been compiled through a systematic study whose methodology and findings are discussed. The article specifically focuses on the objective of exploring KYC-based sanction-compliant best practices for the secure handling of strategic goods and technology during transshipments. It is structured into several key sections comprising an introduction, background to KYC, ICPs, and red flags, methodology, results and discussions, findings, and conclusions.

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2 "CBRN Proliferation Financing: A Perspective from Southeast Asia," United Nations Interregional Crime and Justice Research Institute (UNICRI), October 2023, <https://issuu.com/unicri/docs/cbrn_proliferation_financing._a_perspective_from_s>.

Know Your Customer (KYC): Ensuring Supply Chain Security

KYC should be understood as going beyond just end-user and end-use; it should also include suppliers. It is important to identify not only immediate suppliers but also subsequent levels of suppliers that make up the entire supply chain community. By maintaining a comprehensive database of suppliers and conducting a thorough stakeholder risk analysis, it is possible to better identify each supplier and create risk profiles for them. This proactive approach helps to prevent and mitigate third-party breaches, which can occur when bad actors gain unauthorized access to systems and sensitive information. Notable examples of supply chain attacks, such as those that targeted Accellion, SolarWinds, and Microsoft Exchange, serve as reminders of the importance of this practice.[3]

It is important to emphasize that Know Your Customer (KYC) and Know Your Supplier (KYS) are essential verification strategies for identifying customers and suppliers as well as assessing their suitability for business or trade transactions. Individuals and organizations should refrain from engaging in trade with individuals or entities from sanctioned or restricted countries.[4]

Despite high-level management commitment to managing supply chain risk, the percentage of risk reduction efforts decreased from 41% in 2017 to 26% in 2019.[5] This decline may help explain why it is necessary to enhance due diligence in higher supply chains. Since due diligence is a crucial risk mitigation strategy, it is important to include penalties or negative consequences for non-compliance in contract agreements. Consequently, coordinated reporting and monitoring can be strengthened.

Red Flag Indicators for Ensuring Supply Chain Security

Red flag indicators can be discussed considering end-users and end-uses, products, delivery, payment terms, and so forth and are useful for effective ICP implementation.[6] It is preferable to develop checklists for each activity as applicable to the country or organizational context.

The following are representative, though non-exhaustive, questions that could be part of the checklist:

- Are the shipped commodities compatible with the technical capacities or natural resources of the origin/destination country?

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3 "Supply Chain Due Diligence is Faltering: Here's How to Tackle It," AML Right Source, February 20, 2020, <https://www.amlrightsource.com/news/supply-chain-due-diligence-is-faltering-heres-how-to-tackle-it/>.

4 "Strategic Trade Control Enforcement (STCE) Implementation Guide," World Customs Organization, <https://www.wcoomd.org/-/media/wco/public/global/pdf/topics/enforcement-and-compliance/tools-and-instruments/stce-implementation-guide/stce-implementation-guide-2023-e-final.pdf?db=web>.

5 "Supply Chain Resilience Report," Business Continuity Institute, October 2019, <https://www.thebci.org/static/e5803f73-e3d5-4d78-9efb2f983f25a64d/BCISupplyChainResilienceReportOctober2019SingleLow1.pdf>.

6 Nicole Mantei, "Export Controls: New Red Flag Checklist for your ICP," AEB, August 18, 2022, <https://www.aeb.com/en/magazine/articles/red-flags-trade-compliance-icp.php>.

- Is the shipping route appropriate for the product and destination?
- Are free trade zones or free ports utilized for the shipment?
- Was shipment clearance requested at the last minute?
- Was the bill of landing (B/L) changed?

New dimensions of capacity limitations due to global conflicts such as attacks on vessels in the Red Sea need to be understood as an emerging STC risk. For instance, major freight carriers, including Maersk and Hapag-Lloyd, suspended operations in 2024 through the Suez Canal in order to avoid the Red Sea. They are now rerouting vessels around the Cape of Good Hope, which adds 5,500 to 6,500 kilometers and seven to ten days to a typical trip between Europe and Asia. This extra distance could absorb anywhere from 700,000 to 1.9 million twenty-foot equivalent units (TEUs) of shipping capacity.[7]

Epidemics like Covid-19 or other disasters can heighten vulnerabilities of integrated supply chains due to the emergence of new and dynamic red flag indicators. Therefore, Mutual Recognition Arrangement/Agreements (MRAs) play a crucial role in planning, negotiation, and implementation of cross-border customs administration, ensuring the security of end-to-end supply chains with partner customs administrations.[8]

The main reasons for supply chain risks are unplanned IT or telecommunications outages, adverse weather, cyber-attacks and data breaches, loss of talent/skills, transport network disruption,political change, and new laws or regulations.[9] These situations can be alleviated through strengthening ICPs.

The Relationship between Internal Compliance Programs (ICPs) and Strategic Trade Controls

ICPs serve as a monitoring tool to prevent the intentional or unintentional transfer of strategic goods to prohibited end-users or for prohibited end-uses. It consists of Standard Operating Procedures (SOPs) and internal protocols to effectively identify emerging risks and manage them through export control-related risk reduction strategies. Performing a self-audit is important, which should consider voluntary disclosure, incident reports, and notes. It is crucial to have information analysis systems in place and involve knowledgeable experts. Additionally, software automation is essential for ensuring the secure and efficient delivery of processes, particularly when dealing with large volumes of diverse export control regulations.

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7 Arvis F. Jean, Rastogi, Cordula, and Ulybina, Daria, "Will a Prolonged Rerouting of Ships from Suez Trigger a New Supply Chain Crisis?" The World Bank, January 19, 2024.

8 "AEO Mutual Recognition Strategy Guide," World Customs Organization, <https://www.wcoomd.org/-/media/wco/public/global/pdf/topics/facilitation/instruments-and-tools/tools/safe-package/strategy-guide-for-aeo- mutual-recognition.pdf?db=web>.

9 "Supply Chain Resilience Report," Business Continuity Institute, 2019, <https://www.thebci.org/static/e5803f73-e3d5-4d78-9efb2f983f25a64d/BCISupplyChainResilienceReportOctober2019SingleLow1.pdf>.

Research institutions should share best practices and consider export controls risks within their company's risk registry. They should also provide targeted training and awareness to individuals involved in the handling of exports, supplies, brokering, or publishing controlled goods, software, and technology maintenance. Collaborative projects with the relevant supply chain community, such as the insurance community, can be beneficial. These projects can include clauses in business agreements that address non-compliance and violations. Non-compliance can result in financial penalties, legal consequences, and damage to reputation. Examples of non-compliance activities are provided below.

- Not having SOPs or procedures to follow
- Insufficient administrative procedures to practice or not practicing existing procedures
- Failure to follow SOPs or operational procedures
- Not having required certification/licenses to handle operations
- Failure to report to relevant authorities about suspicious activities

Transshipment Risks Beyond Physical Operations

Transshipment risks are often viewed considering physical operations. Nevertheless, reporting requirements, non-existent global transshipment guidelines, and privately owned ports and terminals act as non-physical compliance risks. This is illustrated below.

Reporting Requirements

It is important to generate, observe, and accept reports in a standardized manner with SOPs. For example, transshipment-related documents must contain notifications/authorization, declarations, observer reports, and landing reports. It is essential to report red flags to state authorities of both vessels by any relevant coastal, port, national, regional, or international organization. Red flag reporting and SOPs should be developed and not only be limited to strategic or dual-use goods and technologies but also consider the misuse potential of new goods and technologies within the country's context. This challenges global security norms.

Global Guidelines for Transshipments

The need for global transshipment guidelines for catching fish was identified many years ago.[10] Nevertheless, equally important transshipment guidelines should be developed, including best practices for handling strategic and/or dual-use goods and technology. Clear definitions, formalized documentation procedures with SOPs, and the use of technologies for the physical monitoring of transshipments have become essential in this regard.

Privately Owned and Operated Ports and Terminals as a Barrier

Oversight and enforcement measures could be challenged when ports and terminals are not

10 "Transshipment: A Closer Look: An In-Depth Study in Support of the Development of International Guidelines," Food and Agriculture Organization, 2020, <https://www.fao.org/3/cb2339en/cb2339en.pdf>.

owned by the government. Little or no oversight of domestic or foreign-flagged vessels landing, transshipping, or receiving port might lead to inadequate information on the volume and composition of the goods transshipped. This can create economic, social, and environmental losses. The role of voluntary non-state sector organizations is pivotal in raising awareness and training on vulnerability-sensitive risk-reduction compliance strategies.[11,12]

Sometimes, it becomes evident that state-owned ports and terminals suffer from poor oversight This is particularly noticeable when there are gaps in the enforcement and implementation of the International Convention for the Prevention of Pollution from Ships (ICP) and when shippers fail to share relevant details. A recent incident exemplifying this issue occurred in May 2021 at Colombo Port in Sri Lanka, where the express pearl transshipment disaster took place. This disasterresulted in the leakage of 25 metric tons of nitric acid and approximately 50 billion plastic pellets into the environment, causing not only environmental damage but also significant socioeconomiclosses.

Methodology

This section describes the sample selection, data collection, and analysis for the study upon which the best practices identified in this article was performed..

Sample Selection, Data Collection and Analysis

The study purposefully selected 10 Asian countries that have STC mechanisms, including customs regulations and procedures that comply with the World Customs Organization. These countries are also a part of international disarmament treaties and have established systems for transshipment handling.

Additionally, the countries had experts who were willing to contribute to the study. Data collection lasted for eight weeks, during which an expert perception survey was conducted. The survey targeted 30 experts from the following 10 Asian countries: India, Bangladesh, Malaysia, Philippines, Iraq, Pakistan, Jordan, China, Indonesia, and Sri Lanka. Furthermore, five expert interviews were conducted with individuals (EX1, EX2, EX3, EX4 & EX5) from the European and Asian region and Brazil. Data analysis was carried out using Excel and thematic content analysis techniques. Data interpretational techniques included concept maps, percentages, and literature arguments.

Results and Discussion

This section describes the best practices highlighted by the experts in light of KYC, sanctions,

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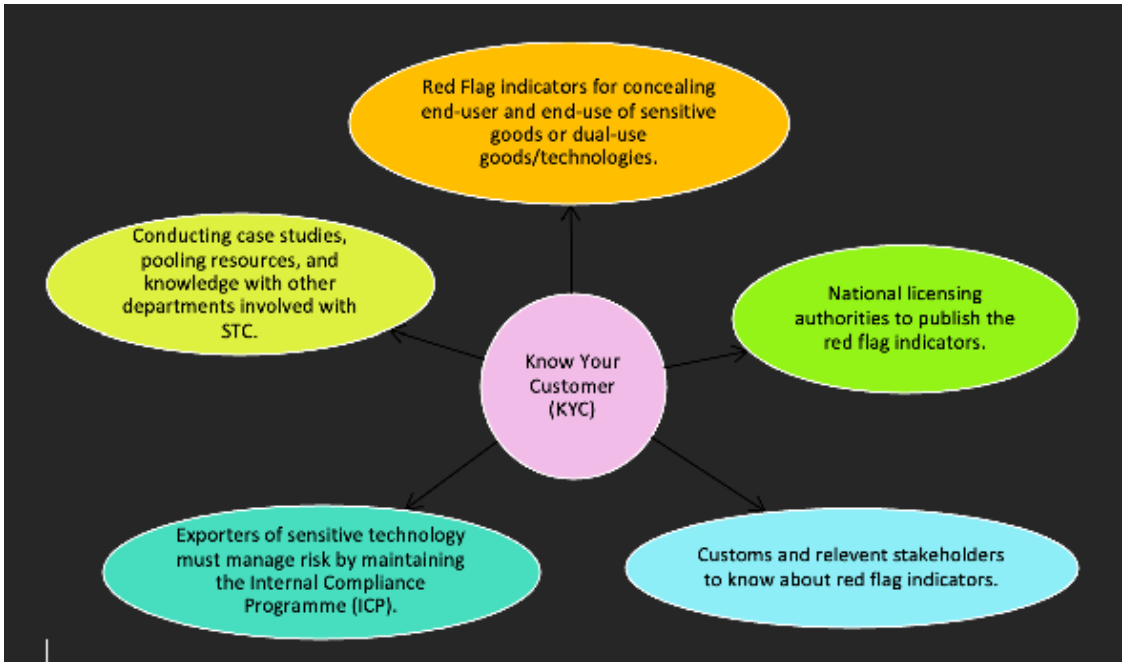
11 "Global Study on Transshipment: Regulations, Practices, Monitoring and Control," Food and Agriculture Organization, June 2018, <http://www.fao.org/fileadmin/user_upload/COFI/COFI33Documents/SBD15en.pdf>.

12 Food and Agriculture Organization, "Voluntary Guidelines for the Marking of Fishing Gear," May 18, 2018, <https://www.fao.org/fileadmin/user_upload/COFI/COFI33Documents/MX136_COFI_2018_Inf30en.pdf>.

STC, digital information-sharing, cyber security, and accountability.

KYC Based on Transshipment Best Practices (Experts' Opinions)

Figure 1: KYC-based transshipment best practices concept map (Survey data, 2023)



As per Figure 1, the following aspects were highlighted by experts as STC-sensitive KYC best practices in handling transshipments.

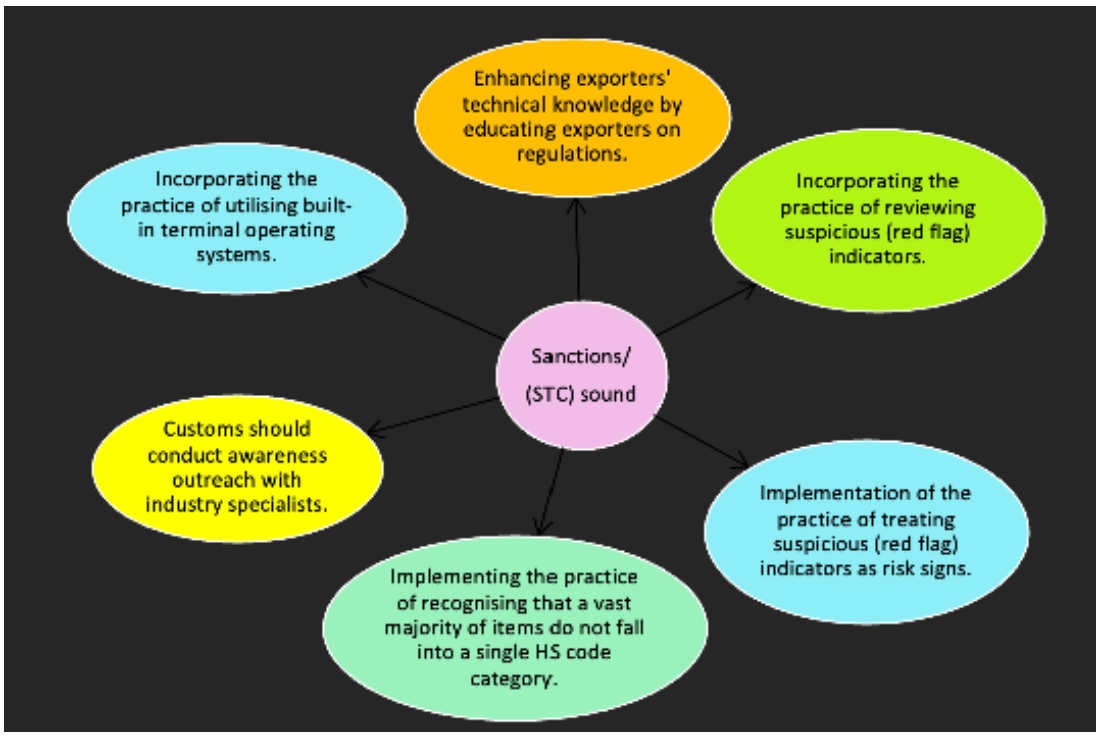
- Red flag indicators for concealing ultimate end-user or end-use of sensitive goods or dual-use goods/technologies (83.33%).
- National licensing authorities should publish a list of red flag indicators (93.33%).
- Red flag during transshipment is a must that relevant stakeholders, including customs, should be aware of (96.66%).
- Sector-specific awareness by customs and licensing authorities is essential (89.99%)
- It is essential to have industry and academic institutions outreach efforts to prevent the proliferation of export-controlled technology and components (93.32%).
- Case studies and pooling resources and knowledge with other departments involved with Strategic Trade Control (STC) are essential (93.33%).
- Those who export sensitive technologies must manage risks related to compliance and enforcement by maintaining the Internal Compliance Programme (ICP) to address the risks, for example, identifying and classifying controlled goods, and risky trading partners and locations (93.32%).

Those who were neutral or disagreed on the points mentioned above responded by comparing the existing situation in their countries and working environments to assess the extent to which the best practices mentioned above had been implemented. In other words, they too recognized the importance of implementing these best practices in their working environments.

Strategic Trade Controls/Sanctions

According to the experts surveyed, the best practices associated with strategic trade controls and sanctions can be summarized as follows:

Figure 2. Sanctions/STC sound transshipment best practices concept map from survey data



Based on the perception survey, the majority of experts strongly identified the need to enhance experts' knowledge on sanctions/STC. They also highlighted the importance of reviewing suspicious indicators and treating them as risk signs, promoting exporters to rely on more comprehensive technical details for export control, and investing more in terminal operations and customs awareness outreach as best practices.

- Enhancing exporters' technical knowledge by educating exporters on regulations (100%).
- Incorporating the practice of reviewing red flag indicators to identify elements of a shipment requiring heightened compliance checks or verification (93.33%).
- Implementation of the practice of treating red flag indicators as risk signs for the prevention of unauthorized diversion of exports to a sanctioned or blacklisted entity (90%).

- Recognition that a vast majority of items do not fall into a single Harmonized System (HS) code category, prompting exporters to rely on more comprehensive technical details for export control (86.66%).

- Customs should conduct awareness outreach with industry specialists regarding the application of the correct tariff codes (93.33%).

- Incorporating the practice of utilizing built-in terminal operating systems to facilitate informed decision-making and enhance security management (83.33%).

Furthermore, the expert interviews reflected ways that ICPs can be used to make STC effective with KYC compliance.

The Importance of ICPs for Resilient KYC-Based Sanction-Compliant STC of Transshipments

According to EX1, the Internal Compliance Program (ICP) can be viewed as a framework of coordinated corporate processes to support the export compliance function for the following reasons:

- Risk management: An ICP provides a systematic approach to identify, assess, and manage risks associated with export controls. This includes risks related to the unauthorized export of controlled goods, technology, or services.

- Regulatory compliance: An ICP helps ensure a company complies with all applicable export control laws and regulations. This includes understanding and adhering to licensing requirements, export restrictions to certain countries or entities, and record-keeping obligations.

- Corporate governance: An ICP is an integral part of good corporate governance. It demonstrates a company's commitment to ethical business practices and corporate responsibility. It also helps foster a culture of compliance within the organization. The above points were also highlighted by EX3 and EX4.

Furthermore, EX2 explained the Internal Compliance Program (ICP) as a:

> *"set of internal policies and procedures to ensure compliance with national or international laws and regulations in the framework of trade controls. To this extent an ICP is not only a matter of interest for the export compliance function in an organization but should involve the whole chain of the internal functions engaged in trade activities, starting from the top-level management, that should be committed to compliance, passing through the sales sectors, the shipping departments, and so on".*

The Importance of a Communication Plan for Resilient KYC-Based Sanction Resilient STC of Transshipments

EX1 described that a communication plan for communicating with relevant stakeholders on

compliance procedures, guidelines, regulatory updates, contact information, and protocols/ standards of communication is indeed crucial due to following reasons:

- Clarity and consistency: A well-defined communication plan ensures that all stakeholders consistently receive the same information. This helps prevent misunderstandings and ensures that everyone remains aligned with compliance procedures and guidelines.

- Timely updates: Regulatory environments can change rapidly. A communication plan ensures that stakeholders are informed about these changes promptly, allowing them to adjust their practices accordingly.

- Responsibility and accountability: Clear communication about contact information and communication protocols clarifies who is responsible for what, which is crucial for accountability.

EX2, EX3, EX4, and EX5 also highlighted similar points.

In addition, EX2 explained that:

> *"a communication plan for communicating with relevant stakeholders the commitment to compliance, is something important, sometimes crucial, in engaging new customers or for letting know to other relevant stakeholders, including national and/or international authorities (e.g., licensing, enforcement, financial, etc.), to what extent a company is committed to compliance and to better explain the way how it is taken into consideration and ensured by all the internal functions. So not only how much a company is committed, but how commitment is being ensured also."*

Digital Information to Ensure Secured Information-Sharing and Dual-Screening (e.g., Manifest and Invoices) with the Support of Relevant Stakeholders of Transshipment Handling

According to EX1 "updating digital information securely is crucial for effective transshipment handling. Here are three best practices:

- Data encryption: All sensitive data, including manifests and invoices, should be encrypted during transmission. This ensures that even if the data is intercepted, it cannot be read without the decryption key.

- Access control: Implement strict access control measures. Only authorized personnel should have access to sensitive information. This can be managed through user roles and permissions in the information tracking systems.

- Regular updates and patches: Keep all systems, such as ASYCUDA, maritime traffic monitoring systems, and terminal operating systems, up to date with the latest patches and updates. This helps to protect against known vulnerabilities that could be exploited.

In addition, regular audits and staff training on data security can further enhance the security of information-sharing in transshipment handling. In addition, blockchain could be used to secure

data and match them with that provided by different stakeholders and automatically assess its consistency.
EX3 and EX4 also agreed on the above points. Furthermore, EX4 mentioned that the following was critical:

- Establish clear roles and responsibilities: Clearly define who is responsible for updating digital information and how this information should be shared.

- Implement data access controls: Implement data access controls to ensure that only authorized personnel can access sensitive information.

- Use secure communication channels: Use secure communication channels, such as encrypted email or file transfer protocols, to share sensitive information.

- Monitor data integrity: Regularly monitor data integrity to ensure that information is accurate and complete.

EX2 highlighted that the:

> *"clearness and completeness of documentation is one of it, to put enforcement authorities (and licensing authorities as well) in the best position to understand what is being shipped. Such documentation should include technical information (description of the goods, datasheet, and so on), and commercial information (e.g., invoice, purchase orders, contracts, etc.), to clearly understand not only what is related to the goods, but also identify the entities involved in the transaction and the shipment, including anyone which is a part of the strategic goods supply chain".*

Strengthening the Accountability of Shippers and Exporters to do their Jobs According to the Provisions of the License

EX1 mentioned that "strengthening the accountability of shippers and exporters is crucial for ensuring compliance with licensing provisions. Based on my experience, the most critical way to achieve this can be described as follows:

- Training and education: Regular training sessions can ensure that shippers and exporters understand the provisions of the license and understand their responsibilities. This should include training on the consequences of non-compliance.

- Audits and inspections: Regular audits and inspections can help to monitor compliance and identify any areas of concern. This not only holds shippers and exporters accountable but also provides an opportunity for continuous improvement.

- Penalties for non-compliance: Establishing clear penalties for non-compliance can deter and encourage adherence to license provisions. This could range from fines to suspension or revocation of the license.

- Promote compliance programs such as Authorized Economic Operators (AEO): In this

case, to avoid duplicating efforts and controls, it should also be explored whether it is possible to have a kind of mutual recognition or synergy between ICP and AEO."

EX2 mentioned that exchanging information between licensing and customs authorities is important especially regarding the respect of license provisions. EX2 also emphasized the significance of engaging with shippers and exporters through outreach activities, training programs, and the publication of information.

EX4 highlighted the importance of conducting pre-shipment audits. For instance, these audits help ensure that shippers and exporters comply with license requirements. Penalties for non-compliance, such as fines or license suspension, should also be imposed. Additionally, providing training and guidance to shippers and exporters on how to comply with license requirements is crucial.

Ways Customs Identify and Implement Operational Best Practices Related to Integrated Supply Chain Security Management with Relevant Stakeholders

According to EX3, customs should identify and implement operational best practices related to integrated supply chain security management with an emphasis on the following:

- Develop standardized procedures for supply chain security management and ensure their consistent implementation (training/adequate staff).
- Use modern technology, such as risk assessment algorithms and tracking systems, to increase supply chain security.
- Collaborate with industry stakeholders to share best practices and jointly tackle supply chain security challenges.
- Introduce modern monitoring equipment such as night vision cameras, drones, and scanners.

EX3 and EX4 propose the development of a global convention or treaty for transshipment compliance. This convention would establish minimum standards and guidelines. It is crucial to consider the contexts of both developed and developing countries equally when designing the convention and proposed systems. Additionally, a communication plan should be developed to promote a culture of integrity surrounding the convention.

EX3 highlights the sensitivity of transshipment information in terms of competitiveness, both politically and economically. Many developing countries have transshipment hubs that must include transshipment audits as a mandatory component of their supply chain security management.

EX1 emphasizes that customs can identify and implement operational best practices related to integrated supply chain security management. This can be achieved through collaboration with relevant stakeholders. Effective communication channels should be established with importers, exporters, carriers, and warehouse operators to identify potential risks and implement security measures. Regular meetings, workshops, and training sessions can facilitate this process. The

implementation of the Authorized Economic Operator (AEO) program serves as an example of such practices.
Furthermore, EX1 highlighted the following regarding risk assessment and management:

> *"Customs should conduct regular risk assessments to identify vulnerabilities in the supply chain. This involves analyzing data from various sources, including cargo reports, intelligence reports, and stakeholder feedback. The findings can then be used to implement risk-based controls and procedures. Also, use of technology: implementing advanced technologies such as automated tracking systems, data analytics, and AI can enhance supply chain security, blockchain, etc. These technologies can help in real-time tracking of goods, anomaly detection, and predictive analysis."*

EX2 stated that post-shipment verification is an important aspect of the periodical revision of certifications granted to economic operators. They also stated the need for focused and unique outreach activities and exchange of information with relevant stakeholders via roundtables, open hearings, and so forth.

Licensing Authorities to Adopt/Update/Develop Red Flag Indicators

According to EX1, an effective alert system is vital for implementing continuous monitoring of stakeholders' feedback and the impact of training. EX2 emphasized that the most relevant best practice is the development of a KYC policy in every company, which may include the adoption of ICPs by companies and stakeholders (including consultants and customs brokers). From this perspective, the entrance of new customers into a market could raise a red flag, as well as the knowledge of the industry in the country of destination or the availability of a large amount of money for purchasing items. Furthermore, unusual delivery options or requests for an unusual path to the country of destination can also be red flags.

EX4 stated that the collection and analysis of data on past shipments to identify patterns that may indicate non-compliance is crucial. Consulting with experts from Customs, law enforcement, and other relevant agencies to identify potential red flag indicators is also important. It is further recommended to regularly update red flag indicators to reflect changes in the law, regulations, and business practices. Red flag indicators should be considered as short-term risk assessment components for building a compliance culture with integrity.

EX3 explained that regularly reviewing and updating red flag indicators based on emerging risks and trends in strategic trade is pivotal. Collaboration with intelligence agencies and industry experts to obtain information on possible threats and vulnerabilities is also necessary. Additionally, developing a feedback mechanism to report and address false positives and false negatives in red flag indicators to refine their accuracy (including the introduction of machine learning or artificial intelligence) is recommended.

Findings

Based on the study, this section delinestes best practices related to KYC, sanctions, and transshipment handling that make strategic trade controls effective as a counterproliferation

strategy.

KYC Best Practices

1. During transshipment, it is essential for all relevant stakeholders including customs to be aware of red flags. These indicators are crucial for detecting attempts to conceal the ultimate end-user or end-use of sensitive goods or dual-use goods/technologies.

2. National licensing authorities should publish a list of red flag indicators. Additionally, sector-specific awareness by customs and licensing authorities is essential.

3. To prevent the proliferation of export-controlled technology and components, industry and academic institution outreach efforts, case studies, pooling of resources, and knowledge with other departments involved with STC are essential.

4. Those who export sensitive technologies must manage risks related to compliance and enforcement by maintaining the ICP to address the risks, for example, identifying and classifying controlled goods, and risky trading partners and locations.

Sanctions-Compliant Best Practices

1. Enhancing exporters' technical knowledge by educating them on regulations is crucial. For instance, customs should conduct awareness outreach programs targeting industry specialists. These programs should focus on topics such as applying the correct tariff code and encouraging exporters to rely on more detailed technical information for export control. This is important because the majority of items cannot be categorized under a single HS code.

2. Incorporating the practice of reviewing suspicious (red flag) indicators to identify elements of a shipment that require heightened compliance checks or verification and combining it with the practice of utilizing built-in terminal operating systems, can facilitate informed decision-making and enhance security management.

3. Implementation of the practice of treating suspicious (red flag) indicators as risk signs is aimed at preventing the unauthorized diversion of exports to a sanctioned or blacklisted entity.

Resilient STC Best Practices

1. ICP should be viewed as a framework of coordinated corporate processes and be published on the companies' intranet pages and include advanced cyber security mechanisms.

2. A communication plan for communicating with relevant stakeholders on compliance procedures and practices is essential.

3. Strengthening the accountability of shippers and exporters by providing them with competency-based training is critical.

4. Customs should identify and implement operational best practices related to integrated supply chain security management.

5. Licensing authorities must update and develop further suspicious (red flag) indicators based on the case reports/studies.

The ICP can be seen as a framework of coordinated corporate processes that aid the export compliance function. It is necessary to develop a communication plan to ensure resilient KYC-based sanction-compliant STC of transshipments. Additionally, measures must be taken to secure digital information, promoting secure information-sharing and dual-screening (e.g., manifests and invoices) with the involvement of relevant transshipment handling stakeholders. The accountability of shippers and exporters should be strengthened to ensure compliance with licensing provisions. Customs authorities should implement operational best practices related to integrated supply chain security management in collaboration with relevant stakeholders, and licensing authorities should adopt/update/develop red flag indicators.

Strategies Support the Implementation of Best Practices

Training first response units to liaise with all relevant stakeholders about possible incidents/accidents and carrying out regular mock drills, while strengthening cyber security for secure information exchange, are essential strategies to be implemented along with best practices. Furthermore, it is pivotal for STC authorities to have regular meetings in line with agencies such as the Ministry of Foreign Affairs, Industry, and Trade to enhance their understanding. In the long run, incorporating counterproliferation into formal, informal, and non-formal education is

important. For example, the university syllabus can include modules on ethics and strategic trade. Additionally, technology like radio frequency identification (RFID) and global positioning system (GPS) can be used to track the movements of cargo in real-time, preventing diversions during transshipment operations. Radio frequency identification (RFID) refers to a wireless system comprised of two components: tags and readers.

Track lock or T-star is a tracking device that can monitor transportation activities, such as tracking the precise location of transport containers during consignment. Currently, in developing countries, it is primarily used for monitoring the transportation of radioactive or nuclear materials.

In terms of issuing licenses for the transportation of dual-use goods, for example, in Sri Lanka, the Sri Lanka Atomic Regulatory Council (SLAERC) obtains all necessary information on individuals involved in transportation as part of their prior assessment of trustworthiness. They also gather information on vehicles to ensure they meet the required safety and security standards for transporting materials of security concern. Additionally, transport security tabletop exercises are conducted to provide hands-on experience in real-case scenarios.

The Sri Lanka Atomic Energy Regulatory Council (SLAERC), which succeeded the Sri Lanka Atomic Energy Authority, was established on January 1, 2015, through the Sri Lanka Atomic Energy Act No. 40 of 2014. As per the Act, SLAERC is required to prepare a transport security

plan and develop human resources within the organization, including those involved in transport activities.[13]

It is understood that some of the containers with dangerous cargo are stored in the port premises for longer periods as they have not been cleared by customs. As these containers are vulnerable to smuggling and explosions, it is essential to have a proper mechanism in place to remove and store them in separate safe locations. It would be better to establish a separate common body to make decisions on dangerous cargo issues within the country, with a strong intelligence service to monitor existing mechanisms and identify potential risks. Recruiting enough qualified staff and implementing screening technologies with maintenance capacities are crucial.

Summary

It has been found that implementing KYC-based, sanctions-compliant resilient strategic trade best practices is crucial for countering proliferation and preventing illicit trade. For KYC-based best practices, it is important to have red flag indicators that can help identify the ultimate end-user or end-use of sensitive goods or dual-use goods/technologies. National licensing authorities should publish and regularly update red flag lists based on research, case reports, incidents, emerging threats, and so on. Managing risks associated with sensitive technologies is essential through maintaining ICP with cyber security and developing a communication plan to coordinate with relevant stakeholders on compliance procedures and practices. Competency-based training and awareness are also necessary.

Implementing KYC-based, sanctions-compliant resilient strategic trade control best practices becomes pivotal when addressing supply chain security concerns in transshipment. Additionally, establishing a single window concept, introducing awards/rewards/special grants, conducting stakeholder analysis, developing standard operating procedures, creating a steering committee, and establishing a treaty or convention to set minimum standards for transshipment compliance are identified as important best practices.

Conclusions

Implementing KYC-based and sanction-sound management strategies can support resilient STC. When it comes to KYC-based best practices, red flag indicators play a crucial role in identifying the ultimate end-user or end-use of sensitive goods or dual-use goods/technologies. To ensure effectiveness, national licensing authorities should publish and regularly update red flag lists, taking into account research, case reports, incidents, emerging threats, and so on. Managing risks associated with sensitive technologies is essential through the maintenance of ICP with cyber security. ICP is vital for the resilient implementation of KYC-based sanction-compliant STC for transshipments. This approach also helps address the challenge of political influence in decision-making, which remains a hurdle to the implementation of risk reduction-based technical best practices.

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13 U. W. K. Haryantha de Silva, "Sri Lankan Experience on Security of Radioactive Materials in Transport from a Regulator's Perspective," International Conference on Nuclear Security, 2020, <https://conferences.iaea.org/event/181/contributions/15756/contribution.pdf>.

Best practices also include treating red flag indicators as risk signs, utilizing built-in terminal operating systems to facilitate informed decision-making and enhancing security management, and by enhancing exporters' technical knowledge through education on regulations, including sanctions.

The development of a communication plan is crucial for coordinating and communicating with relevant stakeholders about compliance procedures and practices. It is also important to include politicians and other relevant stakeholders in the communication plan and foster a culture of integrity. A communication plan for resilient KYC-based sanction-compliant STC of transshipments helps identify the needs of stakeholders and enables the implementation of training and awareness programs to enhance their capacity.

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