Strategic Policy Roadmap

A Structured Framework for Supporting the Implementation of Resolution 1540 in the Context of Technological Developments



This paper analyzes the evolving technological landscape surrounding Resolution 1540 and identifies key considerations for implementation support, indirect proliferation pathways, governance frameworks, and the 2027 Comprehensive Review.

UNSCR 1540
TechHorizon initiative

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Foreword



Scientific and technological developments are reshaping the international peace and security landscape in profound ways. While these developments hold enormous promise for human progress, many of these technologies also possess dual-use characteristics that could increase the risks of proliferation of nuclear, chemical, and biological weapons and their means of delivery. The growing accessibility of such technologies increases the risk of their misuse by non-State actors. Preventing such proliferation remains at the core of the United Nations Security Council resolution 1540 (2004).

Effective implementation of resolution 1540 requires not only strong national measures but also informed engagement with scientific and technical communities whose expertise is essential to understand emerging risks and identify practical solutions.

Produced under the 1540 TechHorizon initiative, this Strategic Roadmap and Policy Report makes a timely and valuable contribution to that effort. It explores how emerging technologies could affect the implementation of resolution 1540 and identifies pathways for strengthening prevention, oversight, and responsible innovation. While it is not intended to prescribe policy, I hope that the insights, analysis, and recommendations presented here will stimulate further reflection and dialogue among policymakers, practitioners, researchers, and other stakeholders seeking to strengthen the implementation of resolution 1540 amid continuing technological transformation.

I commend the University of Warwick, its partner universities, and all those who contributed their knowledge and expertise to this important initiative. This report reflects the value of collective effort, bringing together diverse perspectives and expertise to offer a comprehensive and inclusive assessment informed by a broad community of contributors. I also want to express my gratitude to the European Union for its generous support, without which this report would not have been possible. As technology continues to reshape our world, strengthening the implementation of resolution 1540 will depend increasingly on the strength of such strong partnerships and collaborative approaches exemplified by this initiative.

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High Representative for Disarmament Affairs
United Nations

Framework Overview

Strategic Framing, Technology Landscape and Comprehensive Review

UNSCR 1540 TechHorizon initiative

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01

Strategic Framing

Technology is considered as an evolving implementation environment rather than a separate regulatory domain.

02

Technology Landscape

The roadmap examines risk, implementation support opportunities and service-based pathways to access-ingsensitive capabilities.

03

Comprehensive Review

The framework supports informed consideration in advance of the 2027 Comprehensive Review.

Disclaimer

The view expressed in the publication, including the use of certain terminology, are those of the authors and do not necessarily reflect the official positions of the University of Warwick, its partner institutions, the United Nations, or the European Union.

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Executive Summary

This Strategic Policy Roadmap provides a structured framework for considering the issue of technology development in the context of United Nations Security Council resolution 1540 (2004). It offers independent academic analysis and recommendations to inform deliberations on the implementation of Resolution 1540. Its purpose is to organise the main areas of possible resolution 1540 concern linked to technology, identify the changing risk environment created by advanced and emerging technologies, setting out possible areas for further consideration in respect of the implementation of resolution 1540 and to support the 2027 Comprehensive Review process.

The Roadmap proceeds from a central mandate boundary: UNSCR 1540 (2004) is not intended to serve as the basis for the direct control of specific technologies. The responsibility for national legal measures, control lists and implementation rests with UN Member States, while relevant multilateral export control regimes and other international arrangements play important roles in identifying proliferation-sensitive materials, equipment and technologies. The value of a technology-focused roadmap under the resolution 1540 framework is therefore not to create a new technology-control regime, but to examine how rapid advances in science, technology and international commerce may affect the evolving nature of proliferation risk and the implementation environment for resolution 1540.

The Roadmap identifies three broad areas of concern. First, traditional proliferation-relevant sensitive technologies remain important, particularly those directly relevant to nuclear, chemical and biological weapons and their means of delivery. Second, technology can support counter-proliferation and implementation measures, including in areas such as strategic trade controls, border security, CBRN incident response, material accounting, proliferation finance monitoring, research security and academic engagement. Third, and most significantly, technology can act as an indirect enabler of proliferation. Emerging business models such as X as a Service (XaaS), cloud-based capabilities, automation and AI-enabled systems may create new routes through which non-State actors gain access to capabilities that were historically limited to states or major corporations.

The Roadmap also highlights the evolving ecosystem of possible future mitigation measures. The development of supply-side non-proliferation can be understood as moving from export controls to strategic trade controls, then to strategic trade management, and potentially toward strategic trade services or strategic trade management plus. These terms are used with some overlap in national and international practice and do not represent universally agreed or mutually exclusive categories. This evolution is relevant to technology-enabled services, financial services, industry engagement, and other areas where traditional legislative and regulatory measures may need to be complemented by soft instruments, standards, corporate responsibility, professional norms and voluntary approaches.

Finally, the Roadmap links these issues to the 2027 Comprehensive Review required under Security Council resolution 2663 (2022). The review and associated open consultations provide an opportunity to consider how technology development and related policy issues may support the implementation of resolution 1540, while remaining within the mandate agreed by the Security Council.

SECTION 01

Introduction

This Roadmap provides a possible framework for considering technology development in the context of UN Security Council resolution 1540 (2004). It follows the baseline guidance for a "Strategic Policy Roadmap" and is structured around the relationship between resolution 1540, the international non-proliferation architecture, technology-related risks and benefits, indirect proliferation pathways, and possible future mitigation measures.

The Roadmap is not intended to establish a new technology-control mechanism, nor to identify specific technologies for control under resolution 1540. Rather, it provides a structured basis for considering how technological change may affect the implementation environment of resolution 1540, especially where non-State actors may exploit rapid advances in science, technology and international commerce for proliferation purposes.

The Roadmap is prepared in the context of the UNSCR 1540 TechHorizon Project and is distinct from the project's article publication work. Whereas the article collection brings together contributions from scholars and experts across different fields, this Roadmap is a single structured document designed to map the baseline issues, organise areas of possible concern, and support discussion in advance of the 2027 Comprehensive Review.

Strategic framing

The Roadmap should remain within the scope of resolution 1540. It should focus on implementation support, technology-related risk awareness, and possible areas for further discussion. It should not present resolution 1540 as a direct mechanism for controlling specific technologies.

ROADMAP LOGIC



A structured basis for considering technological change within the resolution 1540 implementation environment.

SECTION 02

UN Security Council Resolution 1540 and the International Non-Proliferation Architecture

Resolution 1540 was adopted by the UN Security Council on 28 April 2004 under Chapter VII of the UN Charter. Its obligations are therefore legally binding on all UN Member States. The resolution requires States to 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. It also requires States, in accordance with their national procedures, to adopt and enforce appropriate effective laws prohibiting non-State actors from engaging in such activities, including attempts, assistance, participation as accomplices, and financing.

Resolution 1540 sits within a wider international non-proliferation architecture. It recognises the binding legal obligations that States have undertaken through treaties and other commitments in respect of non-proliferation. These include the Nuclear Non-Proliferation Treaty (NPT), the Chemical Weapons Convention (CWC), the Biological and Toxin Weapons Convention (BWC), the Comprehensive Nuclear-Test-Ban Treaty (CTBT), the Convention on the Physical Protection of Nuclear Material (CPPNM) and its 2005 Amendment, nuclear-weapon-free zone arrangements, and conventions addressing nuclear terrorism, terrorist bombings, terrorist financing, maritime navigation, fixed platforms and civil aviation. The resolution also exists alongside regional legal instruments and other relevant international politically binding arrangements.

In practical terms, resolution 1540 requires States to take obligations that exist within international non-proliferation instruments and ensure that, through national legal frameworks and other appropriate measures, those obligations are also directed toward non-State actors under their jurisdiction. This is the central connecting function of resolution 1540: it links the international non-proliferation architecture, state obligations, domestic laws and controls, and the prevention of non-State actor access to WMD-related materials, technologies and capabilities.

Element	Role in the 1540 architecture
International non-proliferation instruments	Provide binding or relevant obligations and commitments concerning nuclear, chemical and biological weapons, related materials and means of delivery.
UNSCR 1540 obligations	Require Member States to adopt and enforce appropriate effective measures to prohibit any non-State actor to manufacture, acquire, possess, develop, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery.
National legal and control frameworks	Translate international obligations into domestic laws, control systems and enforcement measures directed at non-State actors.
Non-State actor risk	The central risk object of resolution 1540, including attempts by individuals or entities outside lawful state authority to acquire, develop, transfer, finance or use WMD-related capabilities.

SECTION 03

Resolution 1540 and Technology

UNSCR 1540 (2004) is concerned with the proliferation of nuclear, chemical and biological weapons, their means of delivery and related materials. However, it is not intended that the resolution should be the basis for the control of specific technologies. The mandate of the resolution and the 1540 Committee, as agreed by the Security Council, is limited to requiring UN Member States to adopt appropriate and effective measures, such as legislation, to ensure that non-State actors do not contribute to the proliferation of nuclear, chemical or biological weapons. This includes both acquisition of such weapons and activities through which non-State actors may become sources of technology, materials or services that contribute to the development, production, transfer or use of such weapons.

Technology is therefore relevant to resolution 1540 in two connected ways. First, rapid advances in science and technology may change the nature of proliferation risk. Second, technology may also support implementation, monitoring, detection, enforcement, reporting, awareness and capacity-building measures. The Roadmap should treat both dimensions in a balanced manner.

Successor resolutions provide the formal basis for considering technology in the 1540 context. UN Security Council Resolution 2325 (2017), operative paragraph 7, calls upon States to take into account developments in the evolving nature of proliferation risk and rapid advances in science and technology in their implementation of resolution 1540. Resolution 2663 (2022), operative paragraph 14, again calls upon States to consider rapid advances in science and technology. Resolution 2663, operative paragraph 15, also requests the 1540 Committee to take note, where relevant, of the con-

Roadmap implication

The Roadmap should not identify specific technologies for direct control under UNSCR 1540 (2004). It should identify technology-related risk environments, implementation-support opportunities, and areas for expert dialogue consistent with the Resolution's mandate.

SECTION 04

Key Terms as Defined in Resolution 1540

A technology-focused Roadmap should remain anchored in the operative definitions relevant to resolution 1540. Three definitions are particularly important: non-State actor, related materials, and means of delivery.

Term	Working meaning for the Roadmap
Non-State actor	An individual or entity not acting under the lawful authority of any State in conducting activities that fall within the scope of the resolution.
Related materials	Materials, equipment and technology covered by relevant multilateral treaties and arrangements, or included on national control lists, that could be used for the design, development, production or use of nuclear, chemical and biological weapons and their means of delivery.
Means of delivery	Missiles, rockets and other unmanned systems capable of delivering nuclear, chemical or biological weapons and specially designed for such use.

These definitions are important because they prevent the Roadmap from treating technology in an overly broad or generic manner. Technology becomes relevant to resolution 1540 where it connects to non-State actor risks involving nuclear, chemical or biological weapons, their means of delivery, related materials, or services connected to proliferation.

SECTION 05

Areas of Possible UNSCR 1540 (2004) Concern Linked to Technology

The baseline guidance identifies two broad areas of possible UNSCR 1540 (2004) concern linked to technology: proliferation-relevant sensitive technologies and technology for countering proliferation. The Roadmap should distinguish between these areas because they raise different implementation and policy questions.

5.1 Proliferation-Relevant Sensitive Technologies

The traditional focus in considering technology in the context of weapons of mass destruction proliferation has been on technologies directly relevant to the development, production and use of nuclear, chemical and biological weapons and their means of delivery. In the terminology of resolution 1540, these fall within the broader category of "related materials". Such technologies are normally identified and listed by relevant Multilateral Export Control Regimes (MECRs).

Regime or arrangement	Relevant area
Australia Group	Chemical and biological materials, equipment and related dual-use concerns.
Missile Technology Control Regime	Means of delivery and missile-related dual-use items.
Nuclear Suppliers Group	Nuclear and nuclear-related dual-use materials, equipment and technology.
Wassenaar Arrangement	Military and related dual-use goods and technologies.
Zangger Committee	Nuclear non-proliferation treaty-related trigger list items.

Within the international non-proliferation architecture, the MECRs are regarded as international relevant arrangements under resolution 1540. Although their primary focus is export control, their lists are often used in wider policy and regulatory contexts because many of the regimes are grounded in or connected to multilateral treaties such as the NPT, CWC and BTWC. Technical experts' meetings within these regimes consider proliferation-sensitive technologies and update control lists and guidance, usually through consensus among participating governments.

For the Roadmap, the key point is that the responsibility for controlling technologies through control lists rests with national governments and relevant export control regimes, not with the UN, the Security Council or the 1540 Committee. Resolution 1540 supports the utility of effective national control lists, but its direct contribution to identifying and controlling specific proliferation-sensitive technologies is limited. The Roadmap should therefore avoid presenting UNSCR1540 (2004) as a technology-listing instrument.

5.2 Technology and Countering Proliferation

Technology should also be considered in terms of its potential benefits for countering proliferation and supporting implementation. The baseline guidance notes that less attention has been given to the ways advanced and emerging technologies may support non-proliferation measures. This is a potentially useful area for the implementation of resolution 1540 by Member States and relevant stakeholders.

Broad area	Possible relevance to 1540 implementation support
AI and data-enabled tools	May support strategic trade awareness, non-proliferation control processes, anomaly identification and information triage.
Border and maritime security technologies	May support detection, inspection, situational awareness and risk assessment in border environments.
Intangible Transfer of Technology awareness	May help address challenges related to knowledge, expertise, digital files, services and remote collaboration.
CBRN incident response and law enforcement support	May strengthen preparedness, response coordination and technical interpretation, particularly where capacity is limited.
Material accounting and security	May support securing and accounting of chemical and biological relevant materials.
Emerging technology-enabled business models	May raise questions about New Space, XaaS, biofabrication and other service-based access to capabilities.
Financial and service-related measures	May support awareness of proliferation-related services, including non-traditional financial instruments.
Academic research and collaboration	May support awareness-building, responsible research engagement and implementation-support dialogue.
Hard and soft instruments	May provide complementary approaches through legal instruments, standards, norms and voluntary arrangements.

SECTION 06

Technology and Indirect Proliferation

One of the most important issues for the Roadmap is the role of technology as an enabler of indirect proliferation. The concern is not only that a technology may directly contribute to the development or production of nuclear, chemical or biological weapons. It is also that technology may enable access to capabilities, services, data or forms of expertise that historically would have been limited to states or major corporations supporting state activity.

This issue is particularly visible in the development of "X as a Service" (XaaS) business models. In such models, the "X" may refer to a wide range of services delivered remotely or virtually. The customer or end-user may be less dependent on specific hardware or infrastructure while still being able to access a required capability. These models are typically cloud- or online-based, data-intensive, and increasingly linked to automation and AI.

From a resolution 1540 perspective, XaaS matters because it may alter the relationship between capability, ownership and control. A non-State actor may not need to possess advanced infrastructure, or specialised equipment in order to access certain capabilities. Instead, capability may be accessed through a service based relationship, digital platform, remote workflow, outsourced analytical function or automated system. This does not mean that all such services are inherently proliferation-relevant. It does mean that service-based access to capabilities should be considered as part of the changing technology environment surrounding resolution 1540.

The baseline guidance identifies commercial satellite imagery as one example of a service-based capability, as well as other areas such as DNA synthesis and assembly, computer-aided engineering and simulation, design optimisation for additive manufacturing, nuclear fuel-cycle modelling, and chemical or process engineering modelling. For the Roadmap, these should be treated as illustrative areas demonstrating a broader point: technology can enable indirect proliferation by transforming capability access, rather than by transferring a controlled physical item alone.

The proliferation risk associated with XaaS may be compounded where services adopt input-output "black-box" models, rely increasingly on automation and AI, and reduce human oversight. Such models may make it difficult for service providers to understand, interpret or intervene in potential misuse. The Roadmap should therefore identify technology-enabled services, automation, platform governance, and service-provider awareness as areas requiring further consideration by technologists and policy experts.

Roadmap focus

The indirect proliferation section should not provide operational detail on misuse. It should identify the governance issue: technology-enabled service models may expand access to capabilities in ways that challenge traditional material-transfer assumptions under non-proliferation governance.

SECTION 07

Evolving Ecosystem of Possible Future Mitigation Measures

Moving away from the specifics of technology, the Roadmap should consider the evolving ecosystem of possible future mitigation measures. The question is how States and other relevant stakeholders may continue to meet the aims and objectives of resolution 1540 in an environment where technology-related risks may arise through services, platforms, data flows, digital infrastructures, commercial access models and cross-border collaboration.

The baseline guidance frames this evolution through the development of supply-side non-proliferation. The terms “export controls” (EC), “strategic trade controls” (STC) and “strategic trade management” (STM) are not used consistently across jurisdictions and institutions and are often applied with overlapping meanings; the distinctions used here are therefore intended as a working framework for the purposes of this Roadmap rather than as universally agreed definitions.[1] The historical movement can be understood as a progression from export controls, to strategic trade controls, to strategic trade management, and then toward the greater inclusion of strategic trade services. A further possible development is a more inclusive “strategic trade management plus” approach, particularly in relation to XaaS and similar service-based capability access

Term / working concept	Core focus	Roadmap relevance
Export controls	Typically focused on controls relating to exports and other transfers of controlled goods, technologies and materials.	Traditional foundation of supply-side non-proliferation.
Strategic trade controls	Often used to describe a broader set of controls relating to strategic or proliferation-sensitive trade.	Expands the control environment beyond simple export transactions.
Strategic trade management	Often used to emphasise the integrated management and implementation of strategic trade control systems.	Relevant to implementation capacity and stakeholder engagement.
Strategic trade services	Attention to services such as finance, insurance,shipping and related support functions.	Important for proliferation-relevant services and technology-enabled commercial access models.
Strategic trade management plus	Possible future evolution addressing XaaS, AI-enabled services, cloud capabilities and other indirect access pathways.	Potential organising concept for technology-related roadmap discussion.

This evolution does not replace traditional legislative or regulatory measures. It suggests that, in technology-enabled environments, those measures may need to be complemented by awareness, engagement, industry practices, professional norms, service-provider due diligence, standards and other non-legislative tools. The Roadmap should identify these as possible areas for further expert dialogue and implementation support.

[1] See, for example, UN Security Council 1540 Committee, Voluntary Technical Reference Guide – Export Controls; U.S. Department of State, 1 FAM 450, Bureau of International Security and Nonproliferation; Republic of the Philippines, Republic Act No. 10697 (Strategic Trade Management Act), 2015.

SECTION 08

Hard Law, Soft Instruments and Emerging Governance Pathways

The baseline guidance distinguishes between “hard” legally-binding international law and “soft” international politically binding normative arrangements. Traditional non-proliferation architecture has traditionally relied heavily on hard law, including treaties, conventions, Security Council resolutions and other legally binding obligations. Resolution 1540 itself was adopted under Chapter VII of the UN Charter and creates binding obligations for Member States. This hard-law foundation remains central.

At the same time, technology-enabled proliferation risks may involve actors, sectors and practices that are not easily addressed through hard law alone. The possible measures that go beyond legislation may aim to develop norms outside the traditional hard-law paradigm, with greater attention to soft political arrangements. Such instruments may include multilateral export control regimes, UN General Assembly resolutions, reports and recommendations of UN and international bodies, international standards, corporate social responsibility and other voluntary or non-binding frameworks.

Governance mode	Examples	Potential relevance
Hard international law	Treaties, conventions, Security Council resolutions, legally binding national measures.	Provides binding obligations and the legal foundation for implementation.
International relevant arrangements	Multilateral export control regimes and associated technical guidance.	Support control lists, technical interpretation and policy coordination.
Soft international instruments	UN reports, recommendations, standards, voluntary norms and non-binding arrangements.	Can support awareness, good practices and implementation-support dialogue.
International standards	Standards developed through recognised bodies such as ISO or sector-specific frameworks.	May provide practical reference points for industry, service providers and research organisations.
Corporate social responsibility	Responsible business practices, internal controls, compliance culture and risk awareness.	May be relevant where technology-enabled services or commercial platforms create indirect proliferation exposure.

Two areas noted in the baseline guidance as not yet fully explored are international standards and corporate social responsibility. These may provide possible frameworks to support the implementation aims of resolution 1540, particularly in areas where technology-enabled business models, service providers and private-sector actors play an increasing role in capability access. The Roadmap should treat these areas as exploratory and implementation-support oriented, rather than as substitutes for binding national obligations.

SECTION 09

Strategic Policy Roadmap and the UNSCR 1540 (2004) 2027 Comprehensive Review

Resolution 2663 (2022) provides an important timeframe for this Roadmap. It decides that the 1540 Committee will conduct comprehensive reviews on the status of implementation of resolution 1540, including through open consultations of the Committee in New York, both after five years and prior to the renewal of its mandate. The first review under this cycle is to be held before December 2027.

The 2027 Comprehensive Review provides a clear context in which a technology-focused Strategic Policy Roadmap may make a useful contribution. The Roadmap can help organise issues for consideration in advance of open consultations, especially where technology development affects proliferation risk, service-based access to capability, implementation support, soft governance pathways, and the interaction between traditional control systems and new technology-enabled environments.

The Roadmap should not present itself as a set of mandatory recommendations. Instead, it should identify areas for structured dialogue, future consideration and implementation-support discussion. It can also help clarify where issues fall within the current resolution mandate and where they may be more appropriately addressed through national measures, export control regimes, international standards, voluntary frameworks, industry engagement or academic and technical networks.

Roadmap priority area	Purpose for the 2027 Review context
Clarifying the mandate boundary	Reaffirm that UNSCR 1540 (2004) is not a technology-control regime, while recognising that technology development affects the implementation environment.
Mapping technology-related areas of concern	Organise both proliferation-sensitive technologies and implementation-support technologies without focusing on one specific technology.
Addressing indirect proliferation pathways	Consider how XaaS, automation, AI-enabled services and commercial platforms may affect access to capabilities.
Exploring strategic trade services	Consider whether the evolution from export controls toward strategic trade management plus captures emerging service-based risks.
Considering soft instruments	Explore how standards, corporate responsibility, industry outreach and professional norms may support the aims of resolution 1540.
Supporting open consultations	Provide a structured discussion framework for technology and related policies in the lead-up to the 2027 Comprehensive Review.

SECTION 10

Conclusion

This Strategic Policy Roadmap provides a structured framework for considering technology development in the context of Security Council resolution 1540 (2004) and its successor resolutions. It follows the baseline guidance by placing resolution 1540 within the international non-proliferation architecture, clarifying the relationship between resolution 1540 and technology, identifying areas of possible concern linked to technology, examining indirect proliferation through technology-enabled services, and considering an evolving ecosystem of possible future mitigation measures.

The Roadmap's central conclusion is that technology should be addressed under resolution 1540 neither as separate objects of control nor as a list of specific technologies to be regulated by the 1540 Committee, as this would be outside of the mandate of the resolution and of the Committee. Instead, technology should be understood in the context of changing risk and implementation environment. Rapid advances in science, technology and international commerce may affect how non-State actors access capabilities, how services contribute to proliferation-relevant activities; but also how implementation support can be strengthened, and how the traditional hard international law obligations may be complemented by soft normative focused arrangements , such through the development and adoption of international standards, greater corporate social responsibility (CSR) and stakeholder awareness.

The 2027 Comprehensive Review offers an important opportunity to examine these issues in a structured manner, and support the development of the resolution and the work of the 1540 Committee. A Strategic Policy Roadmap focused on technology and related policies can support that process by identifying key areas for consideration, clarifying mandate boundaries, and providing a basis for dialogue among policy experts, technologists, industry actors, academic communities and international organisations. Its contribution lies not in prescribing technology con-

Annex

Draft Roadmap Logic

Baseline guidance element	Roadmap treatment
UNSCR 1540 (2004) and non-proliferation architecture	Establishes legal and institutional context.
UNSCR 1540 (2004) and technology	Clarifies mandate boundary and role of successor resolutions.
Definitions	Anchors the Roadmap in non-State actors, related materials and means of delivery.
Proliferation-relevant sensitive technologies	Maps traditional technology-control context and MECR role.
Technology and countering proliferation	Identifies broad implementation-support opportunities.
Indirect proliferation	Highlights technology as an enabler, especially through XaaS and service-based capability access.
Future mitigation ecosystem	Frames movement from export controls toward strategic trade management plus.
Hard law instruments and soft normative arrangements	Explores standards, CSR, norms and voluntary arrangements as complements to legal obligations.
2027 Comprehensive Review	Provides the roadmap's strategic timing and contribution to open consultations.

UNSCR 1540 TECHHORIZON INITIATIVE



Supporting implementation of United Nations Security Council Resolution 1540 in a rapidly evolving technological environment.

2027 Comprehensive Review

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