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Counter-proliferation of Weapons of Mass Destruction: Strategies against Terrorism through a Questionnaire-Based Study

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Abstract
The study was conducted with an aim to address the critical issue of preventing the spread and misuse of Weapons of Mass Destruction (WMD) in the context of the threat of terrorist attacks involving nuclear, biological, and chemical weapons, their delivery systems and related materials. The study utilized a questionnaire-based research methodology to gather insights from subject matter experts and the scientific community, providing a comprehensive understanding of the motivations, capabilities, resources, and potential consequences of WMD proliferation. The study results highlighted the multifaceted motivations of potential proliferators, including deterrence, prestige, financial gain, and offensive purposes, necessitating a nuanced assessment of the risks associated with WMD proliferation. It also underscores the significance of understanding the capabilities and resources available to potential proliferators, such as scientific, technological, and industrial capabilities, as well as financial and human resources. Additionally, the study focused on the potential consequences of WMD proliferation, including its impact on regional and global security, the economy, and society. It underscored the need for robust measures to prevent and counter its proliferation. The study also highlighted the importance of nonproliferation strategies, including diplomatic, economic, and military measures, and emphasized different strategies' costs and benefits. It underscores the necessity for organizations to establish due diligence processes, policies, procedures, and training programs, and to collaborate with other stakeholders to address WMD proliferation challenges effectively. Additionally, it acknowledges the potential for technology or expertise to be misused for WMD development. It emphasizes the importance of sharing experiences and best practices to raise awareness and improve risk management. In conclusion, the study provided valuable insights into the risks of WMD proliferation for companies and institutions, highlighting the need for proactive risk management strategies, collaboration with stakeholders, and a deep understanding of the potential consequences and implications of WMD proliferation. It underscores the importance of addressing these risks through a comprehensive and collaborative approach, proactive risk management strategies, and a deep understanding of the potential consequences and implications of WMD proliferation.
Keywords: *Weapons of Mass Destruction, proliferation, questionnaire, strategies, risk management, terrorism*

Article Outline

The article focuses on preventing the proliferation of weapons of mass destruction (WMD) amidst rising concerns over terrorist threats. It highlights the complex motivations behind WMD proliferation by state and non-state actors the critical capabilities needed for such activities, and the strategies to counteract these risks effectively. The research employs a questionnaire-based approach, targeting experts in technology transfer and national security regarding the various

aspects of WMD proliferation among state and non-state actors and the possible counterproliferation measures. This method ensures that the gathered insights are grounded in the practical experiences and knowledge of those directly involved in the field to understand the motivations for WMD acquisition, capabilities of potential proliferators (state as well as non-state actors), types of technology acquired, centers of gravity and vulnerabilities, and international context. The study underscores the importance of understanding the multifaceted motivations behind WMD proliferation. It stresses the need for robust scientific and technological capabilities to be managed responsibly. The article is focused on highlighting the critical need for vigilance and cooperation in addressing WMD proliferation risks. Through leveraging expert insights and adopting a multi-dimensional strategy, stakeholders can better safeguard against the threats posed by the proliferation of WMDs, their delivery systems[1] and related materials[2] particularly in the context of terrorism.

Introduction

As part of efforts by the international communities to prevent the spread of Weapons of Mass Destruction (WMD), increasing attention is being directed towards preventing the proliferation and misuse of dual-use technologies. This is deemed essential globally in light of the threat of use by terrorist and other non-State groups involving nuclear, biological, and chemical weapons (United Nations, 2016). The United Nations recognizes the potential dangers posed by such weapons, including nuclear devices, radioactive material, biological pathogens, and chemical substances and canvassed these as a global issues (Nations, 2024). Preventing the use of WMDs and the spread of their delivery systems requires a comprehensive approach involving arms control, disarmament, and nonproliferation (NATO, 2023).

It is crucial that the scientific community in concerned countries understands the risks associated with their interactions with groups and organizations in suspected WMD-producing nations. These institutions must realize that proliferation-related procurement can occur not only through direct transactions but also through agents, front organizations, and other indirect means. Counterterrorism or antiterrorism involves use of measures, operations, policies and procedures that governments, armed forces, police, business organizations and other institutions use to respond to terrorism threats or acts perceived or real. However, its parameter encompasses both the identification of possible acts and the reactions made in regard to adverse events connected with it. Terrorists may use indirect methods to conceal their true objectives, and therefore vigilance is necessary (Kassenova, 2020; Ouagrham-Gormley, 2012).

Dual-use and arms export controls cover a wide range of physical items as well as software and technology, including conventional arms, delivery systems for WMDs, and parts and components related to WMDs. They are applied to different categories of technology, for instance, the "specially designed" or "necessary" technology for "development, production, or use" of items with nuclear capabilities. Technology and software in these frameworks are considered as part and parcel of the interventions (Bromley & Maletta, 2018).

Some types of software and technologies can be covered by various export control regimes, e.g., Australia Group (AG; focuses on biological and chemical weapons), the Missile Technology Control Regime (MTCR; focuses on delivery system), the Nuclear Suppliers Group (NSG; focuses on nuclear weapons), the Wassenaar Arrangement (focuses on conventional weapons such as small arms and rockets), and country-specific or regional arms export control frameworks. License agreements accompanying technology and software are avenues through which

[1] 'Means of delivery' refers to 'missiles, rockets and other unmanned systems capable of delivering nuclear, chemical, or biological weapons, that are specially designed for such use'.

[2] 'Related materials' refers to 'materials, equipment and technology covered by relevant multilateral treaties and arrangements, or included on national control lists, which could be used for the design, development, production or use of nuclear, chemical and biological weapons and their means of delivery'

technology and software are transferred, such as in the commercial sale of restricted software or technology or products carrying these items (de Bruin, 2022).

An additional challenge undermining the proliferation networks or the non-state actors producing WMDs is the method or medium of delivery of these weapons (Mcisaac, 2011; Salama & Hansell, 2005). In many cases, weapons are ineffective because they are unable to be deployed since they lack the means of delivering themselves, through the use of ballistic missiles, cruise missiles, or UAVs as proliferating states to the question of concern have not yet reached the desired technological level to create these means. But, it is alarming to know that some countries, which are technologically able to do so, are willing to sell the technology or offer it as technical support (Ackerman & Jacome, 2018; Gosden & Gardener, 2005; *Introduction | Nuclear Threat Initiative*, n.d.; Maitre, 2022; Moltz et al., 2003). Thus, the prevention of terrorist attacks or any such events entails preemptive measures not only against the nonstate actors but also against the alleged state actors.

Despite the existence of various relevant treaties (MTCR, AG, NSG, Wassenaar Arrangement), there are state seeking to obtain WMDs, their delivery systems and related materials, often motivated by a perceived power imbalance in their region. Historically, these countries have been overt in their attempts to procure goods and knowledge from Europe and other countries with high technology (Reynolds, 2019). However, after the Gulf War against Iraq in 1990-1991, it was discovered that Iraqi government institutions had not only procured dual-use goods from Western countries but also that Iraqi technicians and scientists had received training in Western Europe and North America. The companies and scientific institutions involved were generally unaware of their contribution to the Iraqi WMD program (Ali, 2001; Baxter et al., 2023; Halliday, 1994; Kim, 2023; Salisbury & Dolzikova, 2023). Further, as far as weaponisation is concerned in today's era, no chemical weapons are being manufactured anywhere, but there is a very large civil industry involved in the production and marketing of what is referred to as precursors, which are considerably easy to transform into weapons.

Governments have become more aware of possible procurement activities and export control mechanisms have been refined to the point where overt procurement of proliferation-sensitive goods and knowledge is difficult. As a result, countries of concern are increasingly attempting to conceal their procurement activities, for example by using transshipment hubs, employing false end-user documentation, engaging in document fraud, and using scientific exchange through students, involvement of concerning entities, matching denied person lists, inconsistent business profiles, freight forwarding as final destination, orders from mismatched locations, technical incompatibility, complex ownership structures and misleading documentation, or advanced technologies that can be used in new or novel ways to enhance adversaries' military capabilities or support mass surveillance programs that enable human rights abuses (*FinCEN and the U.S. Department of Commerce's Bureau of Industry and Security Announce New Reporting Key Term and Highlight Red Flags Relating to Global Evasion of U.S. Export Controls*, 2023; Jack, 2024). There is no reason to believe that terrorists will not use the same strategies (*National Proliferation Financing Risk Assessment*, 2018; *National Proliferation Financing Risk Assessment*, 2024). For example, in 2002, traffickers purchased 5,000 AK-47s from the Yugoslavian army inventories and moved the weapons from Serbia to Liberia through what appeared to be a legitimate deal with Nigeria. Of the planes used in this shipment, one of the planes came from Ukraine but had to refuel in Libya before proceeding (Center for American Progress, 2004 https://www.americanprogress.org/article/the-tangled-web-of-illicit-arms-trafficking/). All of these developments give a testament to the fact that the issue of WMD proliferation is a truly international phenomenon and that the problem needs a genuinely international approach to begin with.

This questionnaire-based research aimed to identify the possible risks for companies and institutions with respect to proliferation of WMDs, their delivery systems and related materials and how these risks can be identified as well as the methods terrorist groups use to obtain

knowledge and goods for their WMD projects and the strategies to overcome the identified risks of proliferation.

Research Methodology

The study was carried out by means of interviews with subject matter experts and scientific community possessing domain expertise in the areas of technology transfer and national security through the questionnaire. The experts were contacted through the institutional email IDs from the respective institute websites. These experts were from various National as well as international organisations including research Universities, research institutes and think tanks like Observer Research Foundation (ORF), Stockholm International Peace Research Institute (SIPRI), Center for Strategic and International Studies (CSIS), National Institution for Transforming India (NITI) Aayog, Centre for Air Power Studies, etc. However, few of the respondents refused to disclose their work institute.

Participants confidentiality

The participation of the experts in the study was voluntary and the questionnaire responses was stored in a secure electronic database. Only authorized researchers had the access to this data. The authors of this research article affirm that any personal information collected from participants during the study has been treated with the utmost confidentiality. All data collected has been anonymized in a secure manner to protect participant privacy. Any identifying details that could potentially disclose the identity of participants have been removed. The findings presented in this article are based on aggregated and anonymized data. The authors respect the rights and privacy of the participants involved and are committed to maintaining the confidentiality of their information.

Study Questionnaire

The following questionnaire was employed to engage the scientific/subject experts to obtain their expert opinions on the potential risks for companies/organisations and institutions with respect to the WMD proliferation. In addition, viewpoints were also acquired on how these risks can be identified and also the methods terrorist groups use to obtain knowledge and goods for their WMD projects and provide the strategies to overcome the identified risks of proliferation.
The intricately constructed questionnaire is outlined below:

- What is your primary industry or area of expertise? (e.g., pharmaceuticals, chemicals, biologicals, technology, finance, research, etc.)
- Dual-Use Technologies: Do you develop, manufacture, or export any products or technologies that could have dual-use applications (civilian and military)? If so, please specify.
- Why did the actor acquire a WMD program? Or What are the motivations of the potential proliferators?
- Are they seeking to acquire WMDs for deterrence, prestige, or offensive purposes? Understanding the motivations of potential proliferators can help decision-makers to assess the risk of proliferation and to develop appropriate countermeasures.
- What are the capabilities of the potential proliferators?
- Do they have the scientific, technological, and industrial capabilities to develop and produce WMDs? Assessing the capabilities of potential proliferators can help decision-makers to identify the most pressing proliferation threats.
- What are the resources available to the potential proliferators?
- Do they have the financial and human resources necessary to develop and produce WMDs? Assessing the resources available to potential proliferators can help decision-makers to gauge the likelihood of proliferation.
- Does simple acquisition present a threat that necessitates a response?

- What is the desired effect the actor wishes to achieve (kill people, gain publicity, retaliation, etc.)?
- What is the vital interest threatened by the actor's use of WMD? Is it national survival, territory, military forces, population, economic interests, etc.?
- Is there any defensive protection in existence or is offensive protection the only viable means of deterring WMD use?
- What type(s) of technology has the actor acquired or developed?
- What are the centers of gravity of this actor, and are they vulnerable?
- What is the international context?
- Are there regional conflicts or tensions that could motivate countries to acquire WMDs? Are there international norms and institutions that can help to prevent proliferation? Assessing the international context can help decision-makers to identify the factors that are driving or restraining proliferation.
- What are the potential consequences of WMD proliferation?
- How would WMD proliferation affect regional and global security? What would be the impact of WMD proliferation on the economy and society?
- What are the options for preventing WMD proliferation?
- What diplomatic, economic, and military measures can be used to deter and counter proliferation?
- What are the costs and benefits of different nonproliferation strategies?
- How can decision-makers weigh the risks and benefits of different strategies to choose the best course of action?
- Are you aware of the potential risks of WMD proliferation for companies and institutions like yours?
- Have you conducted any formal assessments to identify potential WMD proliferation risks within your organization?
- Do you have any policies, procedures, or training programs in place to mitigate these risks? If so, please elaborate.
- Do you conduct due diligence on potential partners, suppliers, or customers to assess their involvement in WMD proliferation activities?
- Do you have a system for reporting suspicious activities or potential violations of WMD proliferation regulations?
- How concerned are you about the financial risks associated with WMD proliferation, such as sanctions or reputational damage?
- How concerned are you about the operational risks, such as disruption of supply chains or damage to facilities, that could result from WMD proliferation?
- How concerned are you about the potential for your technology or expertise to be misused for WMD development or proliferation?
- How concerned are you about the potential for legal liability if your organization is inadvertently involved in WMD proliferation activities?
- What additional steps do you think companies and institutions should take to mitigate the risks associated with WMD proliferation?
- How open would your organization be to collaborating with other stakeholders (governments, industry associations, NGOs) to address WMD proliferation challenges?
- Would you be interested in sharing your experiences and best practices with others in your sector to raise awareness and improve risk management?

Results

The investigation achieved a total response rate of 19 experts who consented to complete the questionnaire and provide their subject matter expertise on WMD proliferation-related matters. These outcomes indicate that the survey was filled out by diverse stakeholders from educational,

governmental, and research sectors, all potentially involved in areas pertinent to WMD proliferation concerns and among the respondents, research was the major focus area (Figure 1).

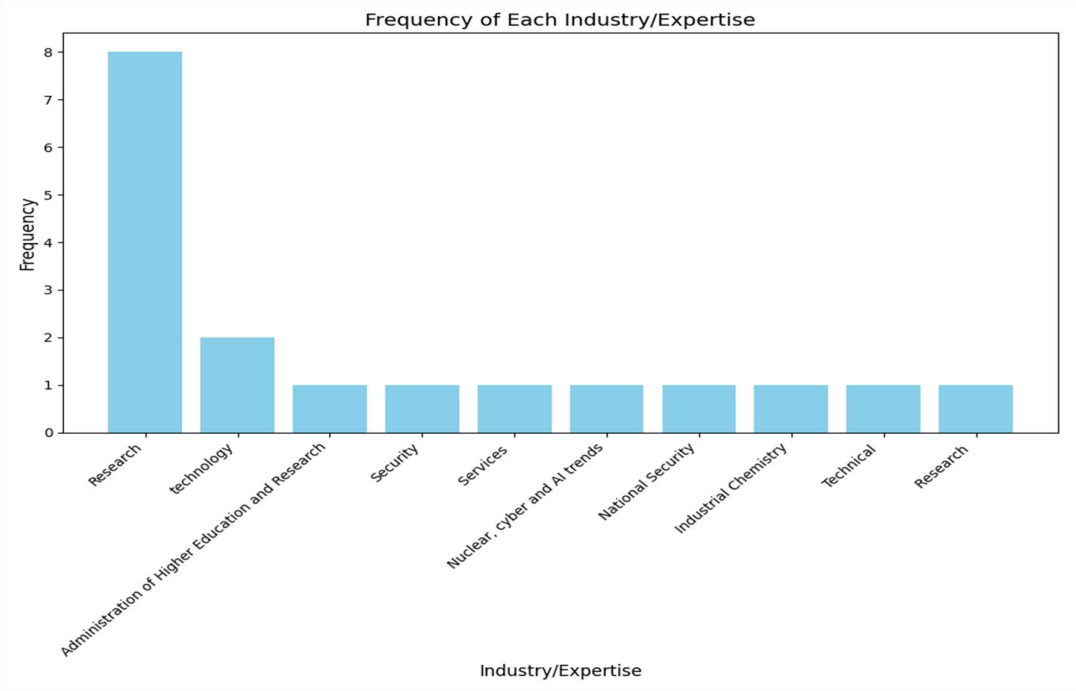

Figure 1: Type of industry/expertise

a. Why did the actor acquire a WMD program? Or What are the motivations of the potential proliferators?

The motivations for potential proliferators in acquiring WMD vary. Some seek WMDs for deterrence, prestige, or offensive purposes. These motivations can help decision-makers assess the risk of proliferation and develop appropriate countermeasures. Additionally, few experts believe that potential proliferators are primarily motivated by financial gain. However, it is important to note that the motivations for acquiring WMDs are complex and multifaceted, encompassing a range of factors such as geopolitical advantage, status, and national security. Understanding these motivations is crucial for assessing the likelihood of proliferation and developing effective strategies to prevent it.

b. What are the capabilities of the potential proliferators? Do they have the scientific, technological, and industrial capabilities to develop and produce WMDs? Assessing the capabilities of potential proliferators can help decision-makers to identify the most pressing proliferation threats.

The ability of potential proliferators to develop and produce WMDs depends on a complex interplay of scientific, technological, industrial, financial, and international factors. While some countries or entities (state or non-state actors) may possess the full spectrum of capabilities required for independent WMD development, others may rely on external support or illicit networks to acquire the necessary materials and technologies. International efforts to prevent proliferation focus on disrupting these capabilities and denying potential proliferators the resources they need to succeed. Especially the non-state actors have high-tech human resources and sufficient liquid funds, enabling them to acquire or develop WMDs. Additionally, they have the financial and human resources necessary for WMD development. It is noted that technological and scientific capabilities are often outsourced, and industrial capabilities are considered vital. Furthermore, it is emphasized that the capabilities of potential proliferators are

dependent on the actor and that they are continually in the process of acquiring or improving resources. Understanding these capabilities is crucial for decision-makers to identify and address the most pressing proliferation threats.

c. What are the resources available to the potential proliferators? Do they have the financial and human resources necessary to develop and produce WMDs? Assessing the resources available to potential proliferators can help decision-makers to gauge the likelihood of proliferation.

Potential proliferators often possess or acquire the financial and human resources necessary to develop and produce WMDs. Many potential proliferators are state actors with significant government budgets (e.g., North Korea, Iran, etc.). These states can allocate substantial funds to WMD programs, often disguised within defense or research budgets to avoid detection. Non-state actors and states under sanctions often engage in illicit activities such as smuggling, trafficking, and other forms of organized crime to generate the necessary funds, establishing legitimate-looking businesses to channel funds and acquire materials without attracting suspicion or using offshore financial centers to obscure financial transactions and maintain anonymity. Countries with advanced educational systems and research institutions train and retain a highly skilled workforce of scientists, engineers, and technicians with expertise in nuclear, chemical, biological, and missile technologies who in turn are capable of developing WMDs. Also, the non-state actors recruit foreign experts through legal or illegal means, including enticing them with financial incentives or coercion and utilize diaspora networks to bring in expertise from abroad. Further, non-state actors expand by investing in domestic education and training programs to develop the necessary technical skills and sending students and professionals abroad to study in fields relevant to WMD development.

To add, experts view was that the technology is not static and cannot be confined. It bound to proliferate and grow. In this age of capitalism, globalization and ideological rivalry, technology proliferation happens for profit making, ideology promotion, etc. So, proliferation motive is not handicapped by technology unavailability, or scientific-industrial incapability. Anybody can procure and spread it in this age of IT revolution and mad rush for profit making. More than scientific or technological capabilities, a potential proliferator has is industrial capabilities; technological and scientific capabilities are now outsourced. The clear comprehension of the main enablers of proliferation and their capabilities allows decision makers to define dissemination chances and create relevant countermeasures accordingly.

d. Does simple acquisition of WMDs present a threat that necessitates a response?

The question of whether simple acquisition of WMD or mere acquisition of such weapons presents a threat that necessitates a response is not straightforward. Nevertheless, based on the received information shared by the experts, this mere acquisition does not necessarily present a threat directly that necessitates a response, however, if a country develops or acquires (for example) long-range missile technologies, then that allows them to expand their deterrent and presence of WMDs in any part of the world is a threat to every part of the world.

The responses from the experts also indicate that the potential threat posed by the acquisition varies depending on the specific actor and their unique motivations. Some actors may seek to increase national power or gain publicity through acquisition, while others may view it as a means of deterrence. Additionally, these experts suggests that diplomatic channels may be required to indirectly respond to simple acquisition, rather than a direct military or economic response. Therefore, the assessment of whether simple acquisition necessitates a response is contingent on the specific circumstances and the actor involved.

e. What is the desired effect the actor wishes to achieve (kill people, gain publicity, retaliation, etc.)? And what is the vital interest threatened by the actor's use of WMD? Is it national survival, territory, military forces, population, economic interests, etc.?

The desired effect the non-state actor wishes to achieve varies and can include gaining publicity, retaliation, deterrence of the target state, and potentially killing people. Additionally, the desire for status, violence, and retribution are also identified as potential motivations for the acquisition of WMDs. It is important to note that the specific desired effect may depend on the individual actor and their unique motivations. Understanding these desired effects is crucial for assessing the potential risks and implications of WMD proliferation and for developing appropriate strategies to address them.

The vital interest threatened by the state actor's use of WMD can vary depending on the context and the actor's motivations. However, the expert suggests that national survival is often at the core of these threats. National survival encompasses a range of elements including the government, military, population, and territory. These elements are considered the basis of a state's survival and can be targeted by WMD use. Additionally, economic interests are also identified as threatened by the actor's use of WMDs. The responses indicates that the use of WMDs can lead to significant destruction and loss of life in the country where such weapons have been used, which in turn can affect the country's economic stability and overall security. Therefore, the use of WMDs poses a direct threat to national survival and economic interests.

f. Is there any defensive protection[3] in existence or is offensive protection[4] the only viable means of deterring WMD use?

To this, the experts suggests that defensive protection against the spread of WMDs is limited, and international collaboration is crucial in this regard. The responses indicate that offensive protection is considered the primary means of deterring WMD use. It is emphasized that major powers have the capability to prevent the proliferation of WMDs, and offensive action is seen as the most viable means of deterring their use. Additionally, the responding experts highlights that the best defence against WMD use is the capability to carry an unacceptable second strike, along with other protective measures such as ballistic missile defence and anti-drone measures. Therefore, the prevailing view is that offensive protection is the most effective means of deterring WMD use.

g. What type(s) of technology has the actor acquired or developed?

The actor has acquired or developed various types of technology, including Electronic Measures and Electronic Counter Measures, aerospace technology, and nuclear weapon technology of different yields, cruise and ballistic missiles capable of being launched from ground, air, sea and undersea, industrial aviation technology. Additionally, the experts suggests that terror groups may seek to miniaturize chemical and biological weapons to enable drones or UAVs to carry out WMD attacks. The technology that an actor has acquired or developed is further dependent upon the actor. If looking at China, its development of hypersonic boost-glide systems and expansion of its missile silos expand its ability to penetrate missile defences, thereby strengthening its deterrent.

It is also noted that there is a significant shift in the technological and scientific landscape for WMD development, indicating that state or non-state actors have likely transitioned from relying solely on internal technological and scientific capabilities to seeking external sources, partnerships or acquisitions for these capabilities (Rajagopalan & Patil, 2024). Further, these

[3] Defensive protection strategies focus on mitigating the effects of WMDs in case of their use such as missile defence system, civil defence measures, Biological and Chemical Defence, and medical countermeasures.
[4] Offensive protection strategies are aimed at disrupting or preventing the proliferation and use of WMDs by adversaries including export controls, counterproliferation operations, Diplomatic Efforts, and cyber operations.

actors recognize the critical role of industrial infrastructure and expertise in advancing their WMD programs.

h. What are the centers of gravity of this actor, and are they vulnerable?

The centers of gravity[5] of the state-actor are primarily related to political leadership and scientific cadre. These centers of gravity are considered vulnerable, particularly in the context of weak political leadership and governance. Additionally, the experts suggests that the vulnerability of these centers of gravity varies depending on the actor, and that political leadership is a key focus. For non-state actors, the various key focus points include leadership, financial resources, communication networks, logistics and supply chains, support base, ideological foundation, safe havens, and availability of human resources. Understanding the vulnerability of these centers of gravity is crucial for assessing the potential risks and implications of WMD proliferation and for developing appropriate strategies to address them.

i. What is the international context? Are there regional conflicts or tensions that could motivate countries (state actors) to acquire WMDs? Are there international norms and institutions that can help to prevent proliferation? Assessing the international context can help decision-makers to identify the factors that are driving or restraining proliferation.

The international context surrounding the proliferation of WMDs is complex and multifaceted. There are regional conflicts and tensions that could potentially motivate countries to acquire WMDs, with factors such as geopolitical rivalries, territorial disputes, and national security concerns contributing to this motivation. Further, as per the experts, that international norms and institutions play a crucial role in preventing proliferation. Diplomatic, economic, and military measures, as well as international cooperation and dialogue, are highlighted as key strategies to deter and counter WMD proliferation. Understanding the international context is essential for decision-makers to identify the driving forces and constraints related to WMD proliferation and to develop effective strategies to address these challenges.

j. What are the potential consequences of WMD proliferation? How would WMD proliferation affect regional and global security? What would be the impact of WMD proliferation on the economy and society?

The potential consequences of WMD proliferation are significant and far-reaching. They pose a grave threat to regional and global security, potentially leading to a destabilizing impact on the international order. WMD proliferation can result in heightened tensions, increased risk of conflict, and the potential for catastrophic consequences, including mass casualties and widespread destruction. Additionally, the proliferation of WMDs can have a profound impact on the economy, leading to disruptions in trade, investment, and overall economic stability. Furthermore, the societal impact of WMD proliferation is substantial, as it can create fear, insecurity, and social unrest, affecting the well-being and safety of populations. Overall, WMD proliferation has the potential to cause severe and widespread harm, necessitating robust measures to prevent and counter its proliferation (Kassenova, 2020; Reynolds, 2019).

As per the responding experts, the potential consequence of WMD proliferation is financial gains by the proliferators at the cost of death and destruction and focus would be more on vertical than horizontal proliferation, given current trends. For example, China's vertical expansion of its own arsenal does change the security and deterrence calculus of countries like the United States. Further, they shared that WMD proliferation brings home the idea of doomsday.

[5] "Centers of gravity" is a concept often used in strategic planning, military operations, and organizational analysis to identify critical elements that are essential for the functioning and effectiveness of an entity, such as a state, organization, or actor. These elements are focal points or sources of strength that, if targeted or compromised, could significantly impact the entity's ability to operate effectively.

The entire humanity is at stake, not just economy or society; it affects the regional security in short and medium time frame. But in larger interest, WMD proliferation is dangerous for global security. Strategic stability can be disturbed by regional/international geopolitical scenario and can have a cascading influence. China modernising its nuclear forces and increasing the number of warheads will create more asymmetry for India, with a possible fallout for Pakistan. North Korean nuclear capability is creating a rethink in South Korea and Japan. This will translate into a cascading impact on security, economy and society.

k. What are the options for preventing WMD proliferation? What diplomatic, economic, and military measures can be used to deter and counter proliferation?

The options for preventing WMD proliferation encompass a range of diplomatic, economic, and military measures. Diplomatically, negotiations and treaties through international cooperation and collaboration, along with the use of diplomatic channels for sanctions, incentives, export controls, and confidence-building measures, are essential for deterring and countering proliferation. Economic measures, such as sanctions, political isolation, International financial measures and support for alternative energy[6] can also play a significant role in preventing WMD proliferation. Additionally, military measures such as conventional deterrence[7], developing and deploying missile defense systems, conducting military operations to disrupt or destroy WMD programs, and enhancing intelligence capabilities and sharing information with allies to monitor and counter proliferation activities are utilized to deter and counter proliferation, with major powers having the capability to prevent the spread of WMDs. It's important to note that these measures need to be pursued simultaneously, and a comprehensive approach involving international norms and institutions is crucial in preventing WMD proliferation.

l. What are the costs and benefits of different nonproliferation strategies? How can decision-makers weigh the risks and benefits of different strategies to choose the best course of action?

The costs and benefits of different nonproliferation strategies are multifaceted and require careful consideration by decision-makers. Economic measures are often deemed most effective, but they can involve high costs and may not always be cost-effective, particularly when diplomatic relations are at stake (Donkervoort & Onderco, 2022; Grip, 2013). Decision-makers must weigh the financial gains against the high costs involved, as well as the risks of conflict escalation and collateral damage. Additionally, understanding the potential risks of WMD proliferation for companies and institutions is crucial, as it can impact financial and operational aspects, such as technology disruption and reputational damage. In assessing nonproliferation strategies, decision-makers should consider the associated costs, operational risks, and potential for disruption, and take steps to mitigate these risks. It's essential to conduct formal assessments to identify potential WMD proliferation risks and collaborate with other stakeholders to address these challenges effectively.

m. Are you aware of the potential risks of WMD proliferation for companies and institutions like yours?

Few of the responding experts asserted their awareness of the potential risks of WMD proliferation for companies and institutions. The risks associated with WMD proliferation include the potential for disruption of supply chains, technology expertise being misused, reputational damage, and economic instability. Additionally, the spread of WMDs can create a threatening environment, disrupt regional stability, and have a significant impact on global

[6] Providing economic and technical support for the development of peaceful nuclear energy programs as an alternative to nuclear weapons programs.
[7] Maintaining a strong conventional military posture to deter potential proliferators from believing that WMDs are necessary for their security.

security. Understanding these risks is crucial for companies and institutions to assess the potential implications and develop appropriate strategies to mitigate the threats posed by WMD proliferation.

As per the expert's opinion, international collaboration, regimes, national commitments and strict action against proliferators, and time-bound disarmament is the way forward through diplomatic measures, military measures, along with economic sanctions, technology and market access denial regime.

n. Have you conducted any formal assessments to identify potential WMD proliferation risks within your organization?

An organization would typically conduct risk assessments in the following ways: evaluating the security of materials and information that could be used in WMD development; reviewing the background and activities of personnel to prevent insider threats; ensuring compliance with national and international regulations on the handling of sensitive materials and technologies; implementing measures to monitor and control access to sensitive areas and information; establishing protocols for reporting and responding to suspicious activities or security breaches, and international collaboration for information-sharing initiatives. Conducting such assessments helps an organization ensure it is not inadvertently contributing to the global threat posed by WMD proliferation and that it is compliant with legal and ethical standards.

Based on the information provided, it appears that the organizations, including the research organisations, universities, and government agencies, have not conducted any formal assessments to identify potential WMD proliferation risks. An expert from NITI Aayog, however, shared that these types of assessments do happen in their institute, but most of these assessments are informal in nature. From the responses received, it was noted that the practices highlighted above have not been followed in ensuring the risk assessment for the controlling the WMD proliferation. Further, there has been a lack of due diligence on potential partners, suppliers, or customers to assess their involvement in WMD proliferation activities. Additionally, there is no system for reporting suspicious activities or potential violations of WMD proliferation regulations. It is crucial for organizations to conduct formal assessments to identify potential WMD proliferation risks and develop appropriate strategies to mitigate these threats.

o. Do you have any policies, procedures, or training programs in place to mitigate these risks? If so, please elaborate.

Based on the extracted information, it appears that most of the organizations (represented by the questionnaire responders) does not have any policies, procedures, or training programs in place to mitigate the risks associated with WMD proliferation. The responses indicate a lack of due diligence on potential partners, suppliers, or customers to assess their involvement in WMD proliferation activities, as well as a lack of a system for reporting suspicious activities or potential violations of WMD proliferation regulations. Additionally, there is no formal assessment conducted to identify potential WMD proliferation risks within the organization. Therefore, it is essential for the organization to develop comprehensive policies, procedures, and training programs to mitigate these risks and ensure compliance with nonproliferation regulations.

In addition to the mitigation process, due diligence process on potential partners, suppliers, or customers to assess their involvement in WMD proliferation activities was also queried through the questionnaire. Conducting due diligence on potential partners, suppliers, or customers to assess their involvement in WMD proliferation activities is a critical step for companies to ensure compliance with national and international regulations, protect their reputation, and avoid legal and financial risks. According to the information provided, the organization does not conduct due diligence on potential partners, suppliers, or customers to assess their involvement in WMD proliferation activities, except for the expert from Centre for Strategic and International Studies. Most of the responders stated that such type of diligence is

not applicable to their respective organisations (mostly educational institutes). This lack of due diligence could pose significant risks to the organization, as it may inadvertently engage with entities involved in WMD proliferation. Due diligence is crucial to ensure compliance with nonproliferation regulations and to mitigate the potential risks associated with WMD proliferation. Therefore, it is imperative for the organization to establish robust due diligence processes to assess the involvement of partners, suppliers, and customers in WMD proliferation activities.

p. Do you have a system for reporting suspicious activities or potential violations of WMD proliferation regulations?

Organizations such as National Regulatory Agencies, Law Enforcement and Intelligence Agencies, Military and Defense Departments, International Atomic Energy Agency (IAEA), Organisation for the Prohibition of Chemical Weapons (OPCW), United Nations (UN), International NGOs, Industry and Trade Associations, etc., play crucial roles in the global effort to monitor, report, and mitigate the risks associated with WMD proliferation. Their reporting systems are essential for ensuring compliance with national and international regulations, facilitating intelligence sharing, and enabling coordinated responses to potential threats.

Based on the information received from the experts, the organization does not have a system for reporting suspicious activities or potential violations of WMD proliferation regulations to their governmental authorities. This lack of a reporting system could pose significant risks, as it may hinder the organization's ability to identify and address potential proliferation activities. It is crucial for the organization to establish a formal reporting mechanism to ensure compliance with nonproliferation regulations and to mitigate the potential risks associated with WMD proliferation.

q. How concerned are you about the financial risks associated with WMD proliferation, such as sanctions or reputational damage?

Based on the information provided, the expert highlights the significant financial risks associated with WMD proliferation, including potential sanctions and reputational damage. The financial risks associated with WMD proliferation for companies that export goods and technology are substantial and multifaceted. They include increased compliance and operational costs, potential legal penalties, reputational damage, restricted market access, higher insurance premiums, decreased investor confidence, and loss of business opportunities. Additionally, the responses emphasizes the importance of understanding the potential severe and wide-ranging consequences of WMD proliferation that affect national security and economic stability, regional peace and cooperation, and the broader international order including nuclear brinkmanship, global sanctions, increased defense spending which in turn cause economic and trade disruptions, undermining International treaties and Global governance challenges which in turn affects the International order. Further, mass casualty potential and displacement and refugee crises cause humanitarian consequences of proliferation and development of WMD programs.

In response to the question, the concerns about the financial risks associated with WMD proliferation are substantial. The potential for sanctions, reputational damage, and economic disruption poses significant challenges for companies and institutions. It is crucial for decision-makers to assess and address these risks to mitigate the potential impact of WMD proliferation on financial and operational aspects. Understanding and addressing these concerns is essential for developing effective strategies to prevent and counter WMD proliferation.

r. How concerned are you about the operational risks, such as disruption of supply chains or damage to facilities, that could result from WMD proliferation?

Responding experts have highlighted the significant operational risks associated with WMD proliferation, including potential disruption of supply chains and damage to facilities.

Experts who have responded to this matter have expressed warning stating that in operating the WMD proliferation tremendous operational risks showing that there are several critical areas that would be most affected. Needs to be cited Supply chain disruptions can be seen as one of the significant concerns due to their deep impact on the possibility of receiving goods and materials. For instance, the measures and limitations applied owing to occurrence or threat of the usage of WMDs may affect movement and delivery of essential commodities, thereby leading to a slow or hindered delivery process. Pharmaceuticals and medical equipment to food and consumables are among the many sectors that can be disrupted hence leading to disruption of normal business and economic activities in societies.

Similarly, they also stress damage to facilities, in this case, the likely to be damaged highly, either as a primary consequence of the use of WMD or as an outcome of related security measures. That hurt could entail the physical erosion of production facilities, research and development facilities, storage depots and distribution centers. It is imperative to note that the consequences of such damage are numerous more than merely the physical loss; they include the possible loss of data and value assets, sites' contamination, and the need for the numerous wipe out and reconstruction. In terms of expenses, especially when many infrastructures are damaged, or the business ceases to function for some time, the expenses for repair or replacement of damaged structures can at times be very high.

These risks can have far-reaching consequences for companies and institutions, impacting their operational capabilities and potentially leading to economic instability and reputational damage. The responses also emphasize the importance of understanding and addressing these concerns to develop effective strategies to prevent and counter WMD proliferation. Therefore, it is crucial for decision-makers to be highly concerned about these operational risks and to take appropriate measures to mitigate the potential impact of WMD proliferation on their operations.

s. How concerned are you about the potential for your technology or expertise to be misused for WMD development or proliferation?

Based on the information provided by the experts, the potential for technology or expertise to be misused for WMD development or proliferation is a significant concern. The experts share that the risks associated with WMD proliferation, including the potential for disruption of supply chains, damage to facilities, and reputational harm for companies and institutions. Additionally, the experts emphasize the importance of understanding and addressing these concerns to develop effective strategies to prevent and counter WMD proliferation. Therefore, decision-makers should be highly concerned about the potential misuse of technology or expertise for WMD development or proliferation and take appropriate measures to mitigate these risks.

t. How concerned are you about the potential for legal liability if your organization is inadvertently involved in WMD proliferation activities?

In the context of concerns about potential legal liability related to WMD proliferation activities, it is essential for organizations to have robust compliance measures, risk assessment protocols, and clear policies to prevent inadvertent involvement in such activities. This includes strict adherence to international non-proliferation treaties and regulations, as well as internal controls to prevent the misuse of scientific research for illicit purposes. To address concerns about legal liability, organizations should ensure compliance with international non-proliferation regulations, implement robust ethical oversight mechanisms and provide comprehensive training and awareness programs for researchers, staff, and collaborators to educate them about the risks associated with WMD proliferation and the importance of ethical conduct in scientific research. Conducting thorough risk assessments and due diligence processes to identify and mitigate

potential risks associated with research activities, collaborations, and technology transfers is another way of mitigating the risks of any legal liability within any organisation.

Based on the information provided by the experts, the organization does not have policies, procedures, or training programs in place to mitigate the risks associated with WMD proliferation. However, it is important for organizations to take proactive measures to prevent inadvertent involvement in WMD proliferation activities and to demonstrate a strong commitment to ethical conduct and compliance with international regulations. Robust compliance measures and ethical oversight implementation, organizations can mitigate the risk of legal liability and contribute to global efforts to prevent the proliferation of WMDs.

u. What additional steps do you think companies and institutions should take to mitigate the risks associated with WMD proliferation?

Companies and institutions should take several additional steps to mitigate the risks associated with WMD proliferation. These steps include:

1. Establishing Robust Due Diligence Processes: Implementing thorough due diligence on potential partners, suppliers, and customers to assess their involvement in WMD proliferation activities is crucial. This can help identify and mitigate potential proliferation risks.
2. Developing Policies, Procedures, and Training Programs: Creating comprehensive policies, procedures, and training programs to mitigate the risks associated with WMD proliferation is essential. This includes implementing measures to prevent inadvertent involvement in proliferation activities and ensuring compliance with nonproliferation regulations.
3. Implementing Reporting Mechanisms: Establishing a system for reporting suspicious activities or potential violations of WMD proliferation regulations is vital. This allows for the timely identification and addressing of potential proliferation threats.
4. Collaborating with Stakeholders: Engaging in collaboration with other stakeholders, including governments, international organizations, and industry partners, to share best practices and coordinate efforts to prevent and counter WMD proliferation.
5. Assessing Capabilities and Resources: Continuously assessing the capabilities and resources of potential proliferators can help in identifying the most pressing proliferation threats and developing targeted mitigation strategies.
6. Implementing Defensive Protection Measures: Investing in defensive protection measures, such as international collaboration against the spread of WMDs, can help mitigate the risks associated with WMD proliferation.

By taking these additional steps, companies and institutions can enhance their ability to mitigate the risks associated with WMD proliferation and contribute to global efforts to prevent the spread of these dangerous weapons.

v. How open would your organization be to collaborating with other stakeholders (governments, industry associations, NGOs) to address WMD proliferation challenges? Would you be interested in sharing your experiences and best practices with others in your sector to raise awareness and improve risk management?

There is no due diligence conducted on potential partners, suppliers, or customers to assess their involvement in WMD proliferation activities, and there is no system for reporting suspicious activities or potential violations of WMD proliferation regulations. Therefore, the organization may not be open to collaborating with other stakeholders to address WMD proliferation challenges or sharing experiences and best practices to improve risk management at this time.

However, it is crucial for organizations to consider collaborating with governments, industry associations, and NGOs to address WMD proliferation challenges. Sharing experiences and best practices with others in the sector can raise awareness and improve risk management. By engaging in collaborative efforts, organizations can contribute to global non-proliferation

initiatives and enhance their own capabilities to mitigate the risks associated with WMD proliferation. Therefore, it would be beneficial for the organization to consider being open to such collaborations in the future to address WMD proliferation challenges effectively.

Discussion and Conclusions

The major issues in the superpower confrontation include the issue of nuclear weapon creation, resources that are utilized to invest in the weapons that may not be used due to their nature of deterring adversaries, the dominance of the deterrence approach which is based solely on the nuclear threat, the possibility of a conventional conflict evolving into nuclear wars, the likelihood of unauthorized use of the nuclear weapons by the military, and lastly the threat of WMDs. Traditionally such concerns have evolved from being super power concern, to regional concern as time goes by. The factors that make some regional adversaries potentially more dangerous than others are the possibility of conventional war between neighbours, the technical and operational capabilities of the adversaries, the historical evidence that shows the armed forces of the adversaries have already had conventional wars, and the existence of weaker measures to prevent unauthorised usage of nuclear weapons. However, there is a need for more attention to be given to chemical and biological weapons, which are also highly dangerous weapons and are categorised as WMDs. Such weapons are easy and cheap to produce compared to nuclear weapons, and thus it become a potential first preference for the states as well as for terrorist organisations seeking WMDs. We also cannot ignore the issue of ethically multilateral and unilateral preemptive actions for disarmament or prevention of procurement of WMDs by the so-called states of rogue. The main concern in this regard is what defines states' entitlement to WMDs and why particular states may have them while others cannot (Book – Ethics and Weapons of Mass Destruction Religious and Secular Perspectives; Edited by Sohail H. Hashmi, Steven P. Lee, 2004; Cambridge University Press).

In addition, WMDs have been the object of various ethical evaluations since their invention. These appraisals have been given not only by the representatives of philosophy and theology but also by politicians and statesmen who make choices concerning the proliferation or non-proliferation of these weapons. However, moral language is present throughout the political spectrum. Politicians rarely speak of power as a reason why they act; instead, they provide reasons why they must act following their capacities given by their position in order to protect citizens of their state or other individuals, to maintain or propagate ideas, and to punish or hold accountable those who have committed wrongs. Surprisingly, even non-state actors, including terrorist organizations, often refer to their moral reasons for action to the self-defense, necessity, or divine orders. It is always the responsibility of moral philosophers to analyze such moral arguments or motivations, in such a way that enables them to identify the bigger ethical systems that the arguments are coming from and to determine whether these arguments are tenable ((Book – Ethics and Weapons of Mass Destruction Religious and Secular Perspectives; Edited by Sohail H. Hashmi, Steven P. Lee, 2004; Cambridge University Press).

Experts have highlighted various aspects related to the risks of WMDs, their delivery systems, and the proliferation of related materials for companies and institutions. The risks cover lack of policies, procedures, or training programs to mitigate these risks, the absence of due diligence on potential partners, suppliers, or customers involved in WMD proliferation activities, and the lack of a system for reporting suspicious activities or potential violations of WMD, their delivery systems and related materials proliferation regulations. Moreover, these regulations deal with the issues related to the monetary and operational risks, possible legal liability, cooperation with stakeholders, and the repercussions of WMD diffusion.

Partnership with governments, industry associations, and NGOs would considerably augment the endeavours to fight and prevent WMD diffusion. Sharing practices and cooperation with other organizations in controlling the WMD, their delivery systems, and related materials proliferation is one of the best ways to raise awareness and improve risk management.

Additionally, decision makers need to evaluate the capacities and means of possible proliferators, and predict the results of WMD their delivery systems and related materials proliferation, so they can explore diplomatic, economic and military options to prevent and face this proliferation (Annawitt & Finaud, 2011; S. Fisher, 1999).

It is also important to consider the societal and global security implications of WMD their delivery systems and related materials proliferation, as well as the potential threats to national survival and economic interests. Decision-makers should weigh the risks and benefits of different nonproliferation strategies and be aware of the potential legal and reputational risks associated with inadvertent involvement in WMD proliferation activities (Eilstrup-Sangiovanni, 2023).

Overall, addressing the risks of WMD proliferation requires a comprehensive and collaborative approach, proactive risk management strategies, and a deep understanding of the potential consequences and implications for companies and institutions.

Our survey participants do not have a common primary industry either they are researchers, technology professionals, security personnel, or administrators. They do this by providing information that can hint whether the peculiar application of the products or the technologies in a country exist, the motivations for WMD proliferation, the capabilities and resources of potential proliferators, as well as nature of threats postulating the acquisition of WMD, their delivery systems and related materials.

The data set continuation as observed further in the aspect of different objectives of actors involved in WMD programs like deterrence, attrition, or financial gains and the core interests concerned, that most likely to be threatened being national survival or economic interests. Cognizance goes even deeper in current security and counter-attack in the scheme of WMD offence and defence use, the type of weapons bought by actors and their vulnerabilities, and the international circumstances which is fair for proliferation.

The author also analyzed the due diligence performance controlling partnerships to prevent WMD activities involvement, systems for suspicious activities reporting and the hazard of financial, operational, reputational, and legal risks WMD, their delivery systems and related materials spreading. Ultimately, it addressed the concerns on further mitigating risks, readiness to engage with partners, and any other comments or worries related to the risks of WMDs for the companies and the institutions.

Overall, the study proved to be very important as it provided the evidence for WMD proliferation risks for companies and institutions and must be considered by identifying effective risk management strategies, engaging contacts with stakeholders, and acquiring deep knowledge about the range of consequences and likelihood of WMD proliferation. It emphasizes the cruciality of this issue with a holistic and collaborative effort, as such, proactive hazard management strategies, in-depth appreciation of the complexities, and implications of WMD proliferation.

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