A Case study on the Success and Failure of Weapons of Mass Destruction Nonproliferation Regimes: Focus on Chemical Weapons Convention and Biological Weapons Convention

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Abstract

What factors determine the success and failure of Chemical Weapons Convention (CWC) and Biological Weapons Convention (BWC)? What factors and conditions enhance the effectiveness of weapons of mass destruction (WMD) nonproliferation regimes? Does correlation exist between the regime effectiveness and the great power's support for the said regimes? If so, under what circumstances does the great power support or reject regimes?

This study seeks to identify the determinants of the success and failure of nonproliferation regime of weapons of mass destruction (WMD) under the U.N. system. The international efforts to ensure the life and safety of mankind from WMD have led to create 19 WMD nonproliferation regimes starting with the Geneva Protocol in 1925. Among 19 WMD nonproliferation regimes, only four regimes (CWC, INF, NPT, IAEA) have strong implementation power and are considered successful while five regimes (PTBT, Tlatelolco, CTBTO, IND NNT, Pelindaba) have not been ratified by states parties and thus have not gone into effect.

Case studies of successful regimes and failed regimes reveal the factors that enhance the regime's ability to implement, and illustrate why the great power selectively supports or rejects particular regimes and helps strengthen the implementation. This study reveals the factors that impel the great power to support or reject the nonproliferation regime of WMD, which can be a very useful tool to evaluate the regime's effectiveness and predict the future of regimes.

By comparing successful cases of the CWC with failures of the BWC, this research asserts that four determinants influence the great power's decision to support or reject regimes: 'non-restraint,' economic interests, the technology gap, and bargaining. Regardless of the counterparts' aims and the type of weapon, the great power provides full support to strengthen the effectiveness of a regime that i)

The Korean Journal of Security Affairs, 27-1 (June 2022) pp. 26-49.

will not constrain its freedom of behaviors; ii) will enhance economic interests; iii) concerns the field where there is a relatively narrow technology gap between the great power and regional powers; and iv) necessitates bargaining with regional powers to garner support.

The implications of this study can be applied to the BWC, which remains weak in responding to North Korea's biological threats on the Korean peninsula. Moreover, provided that future pandemic may not be of naturally occurring diseases but of artificial biological terrorism and deliberate attacks, measures to strengthen the implementation of the Biological Weapons Convention must be urgently needed to respond to large-scale biological incidents including the next pandemic that will require transnational responses.

Keywords: *Weapons of Mass Destruction, Nonproliferation Regimes, Regime Effectiveness, Biological Weapons Convention, COVID-19*

I. Introduction

What factors and conditions contribute to the success of WMD nonproliferation regimes? Are great power's participation and commitment key factors in enhancing regime effectiveness? If so, under what conditions does a great power take a cooperative or coercive stance toward the regime? This study aims to explain the success and failure of WMD non-proliferation regimes by presenting the factors and conditions that affect regime effectiveness and examining theories, hypotheses, and points of contention set forth by existing studies. This study explains the phenomenon wherein great power selectively supports regimes based on certain conditions by identifying the independent variables of factors and conditions. Thus, this research addresses questions of why certain treaties and regimes such as the Chemical Weapons Convention (CWC) are enjoying success as a strengthened regime and why others such as the Biological Weapons Convention (BWC) are comparably insignificant or meager in strength.

This research question, in effect, helps identify any independent variables that make WMD regimes effective. To this question, I assert that the effectiveness of WMD regimes strongly correlates with "Entry into Force (EIF)," "Standing Implementation Organization (SIO)," and "Verification Protocols (VP)". Such aspects are needed not only in establishing regime universality for legitimacy and violation monitoring, but also in supervising the implementation of each member state. When categorizing the aforementioned WMD regimes, I detect a pattern of effective regimes and their common characteristics.

What factors or conditions allow WMD nonproliferation regimes to become successful? Does great powers' participation affect the effectiveness of such nonproliferation regimes? If so, under what conditions do great powers cooperate with or coerce regional powers in the WMD nonproliferation regimes to increase their influence?

To answer the above questions, I posit that there are specific conditions in which the great power supports or rejects WMD regimes and that correlation exists between the great power's strategy and posture and the global distribution of power. Before initiating this research, I assume the following premises derived from a power-centric view of international regimes: i) the great power seeks political security and economic interests; ii) There is no greater authority above states; and iii) a power imbalance exists between the great power and regional powers.

In this study, I examine two WMD nonproliferation regimes in-depth: the CWC as an example of effective (or successful) regimes and the BWC as an example of non-effective (or failed) regimes. I chose the aforementioned cases for the following reasons. Since regime effectiveness can vary across the CBW regimes, I selected the CWC and BWC to demonstrate this. By studying and comparing these regimes, we can identify factors 'most similar' or 'most different' between both successful and

failed regimes.

Under the military dominance based on nuclear weapons which provide deterrence power over chemical and biological weapons threats, the great power has exerted its influence to regulate the weak states or actors not to proliferate WMD programs. However, it is not sufficient to explain regime effectiveness. Factors and conditions, the representative determinants for great power's commitment to the WMD regimes, were analyzed in four ways: 'nonrestraint,' economic interest, bargaining, and the technology gap. In other words, if the regime does not restrict the great power's freedom of behavior, or if it undrestands the pursuit of the economic benefits, the great power has strengthened the regime's effectiveness; otherwise, it has weakened regime effectiveness. These four determinants serve as the underpinnings of my hypotheses that the regime effectiveness is likely to increase when the regime fulfills the determinants for great power's commitment, which is, then, verified through the subsequent research process.

II. Theoretical Debates on Regime Effectiveness

Regimes, in essence, are institutions or rules that determine the decision-making process. As an international relations theory, regime theory is derived from liberal tradition that argues that international institutions or regimes affect the behavior of states or other international actors.[1] Kenneth Abbott first broached the connection between regime theory and international law in 1998.[2] He did not differentiate between legal regimes and nonlegal regimes, still less between hard law and soft law. But many case studies adduced in support of this bold proposition made it clear that the 'regimes' under consideration were founded on legal instrument or had the customary international law status.

In the international arena, institution has been used interchangeably with regime. Krasner defines a regime as a set of explicit or implicit principles, norms, rules and decision-making procedures around which actors' expectations converge in a given issue-area.[3] Oran Young outlines another plausible definition for regimes. He treats regimes as "more specialized arrangements that pertain to well-defined activities, resources, or geographical areas and often involve only some subset of the members of international Society."[4] Many international lawyers have concluded that regime

1) Volker Rittberger, and Peter Mayer, *Regime Theory and International relations* (Clarendon: Oxford Press, April 1995), 12.

2) Kenneth W. Abbott, *Modern International Relation Theory: A Prospectus for International lawyers* (New Haven: Yale University International Law Press 14, 1989), 355.

3) Stephan D. Krasner, *International Regimes* (Ithaca: Cornell University Press, 1982), 2.

4) Oran R. Young, *International cooperation: Building Regimes for Natural Resources and the Environment,* (Ithaca, Cornell University Press), 13.

theory can contribute to international law as well as international relations. Volker Rittberger is the father of German school of regime theory; one of his purposes is to bring the American and German schools closer together. To that end, the conferences that produced the volume were held to bring together American scholars such as Robert Keohane, Stephen Krasner, French Kratochwil, Duncan Snidal and Oran Young with present and former participants in Rittberger's Center for International Relations/Peace and Conflict Studies at the University of Tubingen. Other noteworthy participants include Harald Mueller of the University of Frankfurt, Andrew Hurrell of Oxford University, and Christer Joensson of the University of Lund.[5)]

Not all approaches to regime theory, however, are neoliberal. Realist scholars such as Joseph Grieco have developed hybrid theories that take a realist-based approach to this fundamentally liberal theory. They argue that "realists do not say cooperation never happens. just that it is not the norm: it is a difference of degrees." Neoliberalist, interest-based approaches to regime theory state that international cooperation is achievable without a hegemonic power because a convergence of expectations exists. Regimes facilitate cooperation by establishing a standard of behavior that signals to other actors that a given individual state is, in fact, cooperating. When all states expect each other to cooperate, the probability of sustaining cooperation increases dramatically. Neoliberalists highlight the interactive nature of state relations, refuting that realists neglect the extent to which nations share interests. According to the neorealist view, realists solely rely on the classical "prisoner's dilemma" to model the world in which defection becomes the dominant strategy for both parties due to the pay-off structure. The difference between the model and reality is that states are not same as the prisoners in the dilemma. States can and must continually cooperate with one another whereas prisoners cannot see one another again. One state's decision today can have repercussions in unexpected ways in the unforeseeable future. Mutual cooperation is thus rational: the sum of relatively small cooperation yields greater gains over time as opposed to the seemingly large, yet in the long run meager, gains available from one-time exploitation of an opponent followed by an endless series of mutual defections.[6)]

Realists such as Joseph Grieco propose power-based theories of regimes based on the hegemonic stability theory. Regime theory may appear to be directly opposite to the hegemonic stability theory at times, but realists also refer to hegemonic stability when discussing regimes to explain the change. When used in such ways, realists conclude that a strong hegemonic power is what makes for a successful and effective regime. Liberals and realists, therefore, reach two opposing conclusions.

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5) Volker Rittberger, and Peter Mayer, *Regime Theory and International relations* (Clarendon: Oxford Press, April 1995), 12.

6) See Robert Axelrod, *The Evolution of Cooperation* (New York: Basic Book, 1984)

Regarding the nature of international cooperation and the role of international institutions, liberals believe that international institutions bring about an environment conducive to the convergence of states and their interests, which, in turn, facilitates cooperation through regimes. Realists, on the other hand, believe that regimes are simply reflections of the power distribution in the present international system. In other words, realists view regimes as the creation of powerful states designed to serve their own security and economic interests, and those regimes have no independent power over states.[7)]

Susan Strange, a realist scholar, argues that institutions such as the World Bank, the General Agreement on Tariffs and Trade (GATT), the International Monetary Fund (IMF), and other organizations established following World War II are merely tools that further American grand strategy. Among the variants of realism, neorealism, also referred to as structural realism, is set forth by Kenneth Waltz in his Theory of International Politics and is considered the most powerful. The core difference between traditional realism and neorealism lies in the emphasis placed on the international system for explaining world politics. The system and its structure are determined by the ordering principle, namely the absence of overarching authority (i.e., anarchy), and the distribution of capabilities (or power) among the states. Only the states' material capabilities matter in truth; their identities and interests are largely given and fixed. While no one disputes that anarchy poses severe constraints on state behavior, there seems to be no agreement on how it is defined and how likely states are to cooperate and international order is to form among both neorealists and neoliberals.[8)] This exercise renders crucial implications for global governance theory since most definitions involve questions of government, authority, and governance in some ways.[9)] Likewise, how power distribution shapes state behavior and provides order in international politics − either through the formation of balances of power or through a hierarchy of relations between states with unequal power − underscores that order is a product less of state actions and much less of international institutions than of system structure. In neorealist theory, the possibility for international cooperation is logically slim, though not impossible. As Waltz posits,[10)]

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7) David A. Baldwin, “Neoliberalism, Neorealism, and World Politics,” in David A. Baldwin(ed.), *Neorealism and Neoliberalism, The Contemporary Debate* (New York: Columbia University Press, 1993)

8) David A. Baldwin, “Neoliberalism, Neorealism, and World Politics,” in David A. Baldwin(ed.), *Neorealism and Neoliberalism, The Contemporary Debate* (New York: Columbia University Press, 1993).

9) Helen Milner, “The Assumption of Anarchy in International Relations Theory,” *Review of International Studies* 17 (Cambridge University Press, January 1991), 67-85.

10) Kenneth N. Waltz, *Theory of International Politics* (New York: Columbia University Press, 1979), 105.

> When faced with the possibility of cooperating for mutual gain. states that feel insecure must ask how the gains will be divided. They are compelled to ask not 'will both of us gain' but rather 'who will gain more.' If an expected gain is to be divided, say, in to ratio of two to one, one state may use its disproportionate gain to implement a policy intended to damage or destroy the other. Even the prospect of large absolute gains for both parties does not increase capability.

In contrast to the neorealist emphasis on relative gains from cooperation, neoliberalism stresses that actors with common interests try to maximize their absolute gains.[11] Charles Lipson pointed out that relative gains are more important when discussing security, as opposed to economic issues, rendering cooperation more difficult to achieve, harder to maintain, and more dependent on others and, thus, making states prefer the greater control and increased capabilities.[12] Many neorealists do not recognize the emergence of international regimes and institutions and believe their importance has been exaggerated. Others such as John Mearsheimer are not only skeptical about international institutions but also outright disdainful. In his view, institutions are merely an arena for pursuing power relationships. They have "minimal influence on state behavior and thus hold little promise for promoting stability in the post-Cold War world."[13] Reliance on such institutions, therefore, is apt to lead to more failures than successes. Whilst not all neorealists would go as far as Mearsheimer does, it is clear that many believe international institutions do not have independent effects that merit deeper study. Although there are many criticisms regarding neorealism and its inability to explain the system change and failure to incorporate variables apart from the international system structure, it continues to exert a strong influence on scholars of international relations.

In contrast to the rationalist approach above, scholars of the cognitive school critique rationalist theories on the ground that liberals and realists both use flawed assumptions. These include assertions such as 'nation-states are always and forever rational actors,' 'interests remain static,' and 'different interpretations of interests' power are not possible.' Cognitivists also argue that even when the rationalist theories employ iterated game theories where the future consequences affect present decisions, they ignore a major implication of such iteration: learning. Consequences from an iterated game enable actors to look backward to the past as well as forward

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11) Arthur A. Stein, "Coordination and Collaboration: Regimes in an Anarchic World," *International Organization*, Vol. 36, No. 2 (Cambridge: MIT Press, spring 1982), 318.

12) Charles Lipson, "International Cooperation in Economic and Security Affairs.," *World Politics 37* (Cambridge: Cambridge press, October 1984), 15-18.

13) John J. Mearshiemer, "The Fales Promise of Internatinal Institutions.," International Security 21/1 (Cambridge: MIT Press, 1995), 49.

to the future. Therefore, one's decisions today are not the same as one's decisions tomorrow not only because the actors are taking the future into account but also because one is taking past lessons into account.

Finally, cognitivists use a post-positivist methodology that does not correspond to their analytic purposes. The post-positivist methodology does not believe that social institutions or actors can be separated from their socio-political context for analytic purposes. Thus, the cognitivist approach is sociological or post-positivist rather than rationalist. In sum, for the cognitivists, not only interests or power matter but also perceptions and environment matter.[14)]

III. Success of WMD Regime: CWC

CWC's 20 years of history can be described as a resounding success. The factor behind CWC's impressive success is one of the most ambitious multilateral disarmament treaties in force today. Over 190 states support the convention, and the SIO, the OPCW secretariat, has performed over 3,000 routine inspections and has yet to find significant breaches of its strict classification procedures outlined by the Annex. In addition, member states have enacted legislation to implement the CWC and enforce its provisions on the national level. Currently, many national authorities have a better understanding of scheduled chemical activity within their borders and of activities involving all toxic chemicals and precursors. The significance of this achievement cannot be overstated.[15)]

1. Determinants of the great power's commitment on the CWC

1) Nonrestraint

The CWC, a global regime that extended from the Wyoming Treaty, does not seek to constrain the great power's behavior. From its inception and onwards, the United States and the Soviet Union participated in the process of designing the convention, including its preamble, articles, and annex on implementation and verification so that the end result would not become a shackle to their interests. Chemical weapons, in their nature, are inexpensive and are relatively easy to produce, even by small terrorist groups, to create mass casualties with small quantities. This means that the great powers and other regional powers can freely reproduce and, in some situations, even use these weapons when they are willing.

U.S. President Bill Clinton deposited the U.S. instrument of ratification for the Chemical Weapons Convention (CWC) with the United Nations on April 25, four

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14) Hans Clever, Andreas, Peter Mayer and Volker Rittberg. *Theories of International Regimes*. (New York: Cambridge University Press, 1997), 6.

15) Daniel Feakes, *"*Evaluating CWC verification System*," CWC Review Conference*, 2002, 19.

days before the treaty entered into force. This last-minute action, made possible by the Senate's approval of the resolution regarding 'advice and consent to ratification,' allowed the United States to become a founding party to the convention. Prior to the final vote, former senator Joe Biden submitted five motions to strike each of the five "killer" conditions, which were removed by majority votes.

The first condition that the Senate rejected required ratification by China, Iran, Iraq, Libya, North Korea, Syria, and all state sponsors of terrorism before the United States could join the convention. The second condition prohibited the deposition of U.S. instruments of ratification until the president could certify that Russia had also ratified the treaty, which was found to be highly improbable before the April 29 deadline. Furthermore, the condition required Russia to forgo all activity on its chemical weapons program and required certification of Russian compliance with the 1990 U.S.-Russia Bilateral Destruction Agreement. The third condition required presidential certification that the Central Intelligence Agency has a high degree of confidence in detecting "militarily significant" violations, which were defined to be the acquisition or storage of 'one ton of chemical agents.' The administration had previously pointed out the benefit of CWC to intelligence efforts and said it would not be able to deposit the U.S. instruments of ratification under such an exacting condition. The fourth condition required the president to bar inspectors from states deemed to be sponsors of international terrorism and from states in violation of the U.S. nonproliferation and export and import laws. The last condition the Senate rejected called for amending the convention by eliminating Article X and changing Article XI to permit trade restrictions on exchanges and cooperation on chemical technologies.[16] After receiving confirmation that the CWC will never restrain the United States and its freedom of action, U.S. Senate ratified the CWC and entered it into force.

2) Economic Interests

The drive behind great powers' extensive support for CWC is economic interest. Great powers select which regimes they support based on economic interests. Washington sought chemical nonproliferation and disarmament not only to maintain stability but also to lower the maintenance expense of its chemical arsenals.

In response to a congressional request, the GAO examined the Department of Defense's cost estimates for destroying and demilitarizing existing stockpiles of unitary chemical munitions and producing proposed binary chemical munitions. The U.S. Army Toxic and Hazardous Materials Agency estimated the total program costs for construction and operation of demilitarization facilities at every chemical munition storage site to be about $1.7 billion. However, the estimated cost of the

16) Eric J. Leklem, "Senate Gives Advice and Consent; U.S. Becomes Original CWC Party," Arms Control Association, April 1997: https://www.armscontrol.org/act/1997-04/press-releases/senate-gives-advice-consent-us-becomes-original-cwc-party (Retrieved on 20 Oct 2020)

demilitarization and destruction program could vary by as much as 30 percent. The Chemical Warfare Review Commission projected that the total production costs for three binary systems over the next eight years would amount up to $2.749 billion, including $178 million for research and development, $312 million for facilities, and $2.259 billion for production.[17] This estimated maintenance cost for the chemical arsenal would have increased further had the decision been delayed.

Aging chemical arsenals are not only a bottomless pit to waste funds but also a safety liability. As evidenced, abandoned chemical weapons in Iraq have wounded U.S. soldiers due to leakage during the Iraq War. Aging chemical arsenals, in this sense, have the potential to incur massive costs to a society, both economically and socially. Any major leakage is likely to lead to massive disasters and claim many lives, and chemical weapons do not discriminate between civilians and soldiers. Such a disaster would lead to societal panic, and the recovery costs would be economically burdening. All in all, decrepit chemical arsenals prove more burden than an advantage.

3) The Bargaining

Under the CWC, bargaining between the great power and regional powers was established. Through the bargaining process, the great power provides compensation to the state parties that declared and destroyed chemical weapons. This bargaining promotes the regime effectiveness of CWC. First, the CWC supports the national implementation of the Convention by providing training, organizing exchanges and workshops, and facilitating on-site assistance with declarations and legislation. This support program leads to positive effects in other fields, contributing to economic and technological development. Second, the CWC provides a wide range of capacity-building activities that aim to support the scientific and economic development of its member states. International cooperation and capacity building are promoted in many areas, ranging from legal assistance to chemistry professional training programs. Third, the CWC provides training programs to build the capabilities of its members to ensure their preparedness to respond to the threat of a chemical incident. Fourth, the CWC provides financial support to member states whose economy is in transition through scientific exchanges and internships and the exchange of laboratory equipment. Finally, the organization funds research projects and scientific and legal conferences relevant to the Convention. The CWC can provide technical assistance to member states including assistance with the destruction of chemical weapons and independent chemical analysis. The Organization offers audits of national laboratories to support the establishment of quality assurance systems.[18] These benefits, in the end, provided for the state parties

17) The United States General Accounting Office, Fact sheet to the Honorable Marvin Leath, House of Representatives, “Chemical Munitions Cost Estimates and Production,” October 1985: https://www.gao.gov/assets/90/86883.pdf (Retrieved 20 Oct 2020)

of the CWC, contribute to facilitating bargaining between the United States and regional powers.

4) Technology Gap

In the production chain of chemical weapons, largely, civilian technologies and materials can be diverted for military use. Furthermore, the technology and infrastructure required to produce chemical weapons are considerably less expensive than those required for nuclear weapons. Consequently, any nation whose chemical industry is sufficiently advanced can easily manufacture chemical weapons agents even in civilian chemical plants. Facilities used to manufacture fertilizers, insecticides, pharmaceuticals, and petrochemicals can rapidly be turned into the producer of chemical weapons agents.[19] Chemical and biological weapons are not only of interest to nations. Increasingly, terrorist groups will turn to these weapons. The Aum Shinri Kyo sect that released sarin gas in the Tokyo subway system had a surprisingly well-developed technical infrastructure. This included front companies purchasing material and equipment, advanced laboratories, extensive chemical manufacturing facilities, and several hundred tonnes of 40 different kinds of chemicals. One estimate suggested that the materials together could have produced about 50 tonnes of chemical weapons agents to kill as many as 4.2 million people. In fact, it would be possible to produce lethal chemical or biological weapons in sufficient quantities to use in terrorist attacks with far more modest resources than those of the Aum Shinri Kyo sect. The level of technological sophistication required would be comparable with that already seen in sophisticated bombs that have been used against civilian aircraft. Another source pointed out that the technical challenge is equivalent to the clandestine production of chemical narcotics or the refinement of heroin.[20]

The technology used in manufacturing chemical weapons is not cutting-edge but more akin to the level of the technology during World War I. The recipe to compound chemical agents can be acquired even through the Internet. In the field of chemical science, the technology gap between the great power and regional powers is narrow. This means that the great power has little to lose while mutual on-site inspections are conducted. The less advantage a great power has to relinquish, the more likely it is to support the regime, thus leading to greater effectiveness.

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18) Official OPCW Homepage: https://www.opcw.org/work/achieving-universality-convention (Retrieved20Oct2020)

19) Lord Lyell, "Chemical and Biological Weapons: The Poor Man's Bomb," North Atlantic International Secretariat, 4 Oct 1996: https://fas.org/irp/threat/an253stc.htm(Retrieved18October2020)

20) Ibid.

IV. Failure of WMD Regime: BWC

1. Determinants for Great Power's Commitment to the BWC

1) Nonrestraint

The U.S. administration eventually concluded that any biological threat could be countered with U.S. nuclear arsenal.[21] Nixon administration hoped that the end of biological weapons program could bolster the image of the United States as a whole. In light of rising opposition to the use of non-lethal chemicals in Vietnam and other events such as the Skull Valley sheep kill in Utah,[22] Nixon's statement purposely omitted some chemical agents while others were simply overlooked. As an exception to the no-first-use policy, which his statement reaffirmed, Nixon made a difference between riot-control agents and herbicides.[23] Both agents were used in Vietnam. The other major omission in Nixon's statement was about toxins.[24] Since the U.S. Army wanted to continue studying SEB (Staphylococcus enterotoxin), we can infer that the great power avoids what regime stipulates when regime restrains its behavior.

There is no barrier between offensive and defensive biological programs because of "biological dual-use specialty." It means any biological agent can be used for peaceful purposes, such as medicine, prevention, protection, or for non-peaceful purposes, such as development and production of biological weapons.[25] The biological dual-use specialty could be used as an excuse for the great power not to support the BWC.

2) Economic Interest and Technology Gap

The U.S. has a dominant position in the market with 48.2% of the firms in the

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21) Eric Croddy et al. *Chemical and Biological Warfare: A comprehensive Survey for the Concerned Citizen*, Singapore, 2002, p.238

22) The Dugway sheep incident, also known as the Skull Valley sheep kill, was a 1968 sheep kill that was connected to U.S. Army chemical and biological warfare programs at Dugway Proving Ground in Utah. Six thousand sheep died on ranches near the base, and Army testing chemical weapons was widely blamed for the incident, although alternative accounts have been offered. A report, commissioned by Air Force Press Officer Jesse Stay and first made public in 1998, was called the "first documented admission" from the Army that a nerve agent killed the sheep at Skull Valley.

23) Jeanne Guillemin. *Biological Weapons: From the Invention of State-sponsored Program to contemporary Bioterrorism,* Colombia University Press, 2005, pp.122-127.

24) Albert J. Mauroni, *America's Struggle with Chemical-Biological Weapons,* Greenwood Publishing Group, 2000, pp. 49-60.

25) Permanent Mission of The People Republic of China to the United Nations and other International Organization in Vienna, "Dual-Use Biological Agents and Related Equipment and Technologies Export Control List (https://www.fmprc.gov.cn/ce/cgvienna/eng/dbtyw/fks/t127628.htm) Retrieved on 15 August 2020.

industry operating out of the U.S. firms. The firms in the Asia Pacific area hold 24% of the market, followed by Europe (18.1%) and the Middle East (1.8%). The rest of the world closes up the remaining 7.9%.[26] According to a report from Global Market Insights, the biotechnology sector was valued at over $330.3 billion in 2015, and its value is expected to be more than double to $775.2 billion by 2024 at a compound annual growth rate of 9.9 %. (See Figure 2.) Biotechnology has been heralded as the potential basis of a new arena of U. S. economic hegemony.[27] This hegemonic status of the bio-industry has been maintained due to the technology gap. If the verification protocol was established, industrial security of the U.S in the area of life science would be leaked to the developing countries closely chasing the United States. In short, the United States would have so much to lose whereas chasing countries would not.

When Obama was elected as president of the U.S, many liberalists expected that there would be policy changes to the BWC because the Obama administration planned to announce a new policy to curb the spread of biological weapons. In 2001, the Bush administration abruptly withdrew from a lengthy negotiation to create a verification mechanism. As a reason for such withdrawal, it cited, in part, the regulatory burdens that verification would place on the American pharmaceutical industry and the military's bio-defense research activities. Restarting those negotiations would also likely invite demands from Russia and Iran that could undermine the effectiveness of the broader treaty, according to experts on biological weapons. But nothing changed; the Obama administration reaffirmed the Bush administration's opposition to an international regime that would verify stockpiles of anthrax, smallpox, and other suspicious agents.[28]

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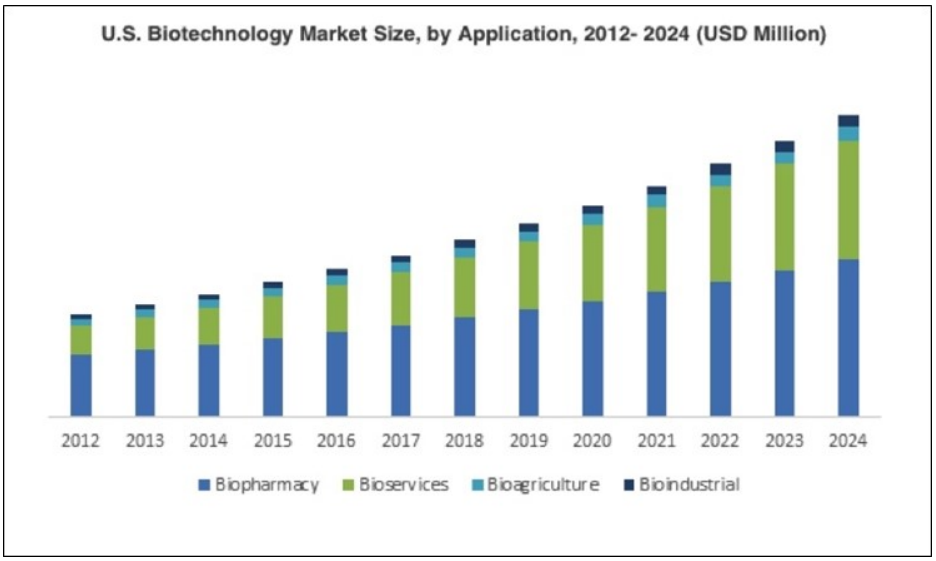
26) Market Line Industry Profiles. "Global Biotechnology December 2019." Click "Quick Buy." (https://store.marketline.com/report/ohmf8274--global-biotechnology-6/) Retrieved on Apr. 27, 2020.

27) Thomas Reifer, "U.S. Hegemony and Biotechnology: The geopolitics and lead technology," Institute for Research on World-systems working paper #9, University of California, Riverside. 29.April. 2014

28) Mark Landler, "Obama Administration Takes a New Approach to Biological Weapons," New York Times, 8th Dec 2009(https://www.nytimes.com/2009/12/09/world/09biowar.html,Retrievedon11November2020)

<Figure 1> U.S. Biotechnology Market Size, by Application, 2012-2024(USD Million)



Source: Global Market Insights Report, "Massive Growth for the Biotechnology Market by 2024," (https://www.contractpharma.com/contents/view_breaking-news/2018-01-26/massive-growth-for-the biotechnology-market-by-2024/) Retrieved on 15 August 2021.

3) The Bargaining

In the BWC case, the bargaining between the great power and regional powers was hardly established. The European Union (E.U.) is supporting BWC through a Council Decision (BWC Action) and previously through E.U. Joint Action. Such Actions are time-limited projects that require coordinated actions by E.U. member states whereby human and financial resources, know-how, equipment, and so on are mobilized to attain the specific objectives set by the E.U. Council. The Actions also commit the Member States and conduct of their activity to the positions they adopt.[29)]

The European Security Strategy recognized biological weapons as one of the main threats to collective security. Because only biological threats continue to grow as advances in biological technology enable easier production of more serious biological agents. Under the E.U. strategy against the proliferation of WMD, the Council adopted the Action Plan related to reinforcement, implementation, and universalization of BWC on 20 March 2006. The strains exist

29) United Nations Office at Geneva, "BWC Action: BWC and the European Union" (https://www.unog.ch/unog/website/disarmament.nsf/(httpPages)/F502359025E15537C1257AC40046060E?OpenDocument&unid=7EA198C35415C020C1257F9B003E1BB1) Retrieved on 15 August 2020.

between the E.U. and the U.S over the future direction of the BWC regime. Those differences were most apparent in 2001 when the Bush administration rejected a verification mechanism to monitor compliance with BWC that the EU had supported.[30] Since then, the United States has consistently resisted efforts to create international institutions to supervise the implementation of BWC because it fears these might leak U.S. industrial secrets.

Four determinants could weaken the U.S. commitment to BWC and, thus, its effectiveness.

i) BWC seriously constrains the U.S. research and development of biological technology. These efforts are needed to maintain dominance over regional powers. If the verification protocol is ratified and entered into force, U.S. could not conduct any experiments on the 67 kinds of viruses and toxins regulated by BWC;

ii) The great power seeks economic interest. The biotech industry is a source of prosperity for America's future. If the verification protocol were agreed upon and established, the U.S. Bio-industry might lose its monopoly status by leaking industrial secrets;

iii) The hegemonic position comes from the technical difference between a leading country and the chasing countries. The biotechnology gap is wider than any other field of science. The larger the technology gap, the less likely it is to reach an agreement between the parties. Technical difference or gap is directly linked to economic benefits; and

iv) It is unlikely that the bargaining will be formed in the BWC. The great power wants to regulate regional powers and weaker states but the great power does not want to be constrained by the rule of the BWC. Regional powers and weak states would not get any compensation from the great power for implementing the BWC if the great power did not support it. The regime effectiveness is inevitably low in the absence of bargaining between the great power and regional powers.[31]

V. Comparative Analysis

While economic and environmental regimes are relatively successful in promoting international cooperation, WMD nonproliferation regimes tend to be state-centric and dominated by realist views. As a result, the possibility of

30) Arms Control Association, "BWC State Tackle National Implementation" Oct. 2007 (https://www.armscontrol.org/act/2008-01/bwc-states-tackle-national-implementation) Retrieved on 15 August 2020

31) Park Ki-Chul, "An Inquiry for Weapons of Mass Destruction Nonproliferation Regime Effectiveness: Great Power's Commitment and Implication for North Korea's Biological Weapons Threats", Ph.D. Dissertation, Korea Univ. Feb. 2021. p. 123

multilateral international cooperation remains low and, furthermore, the effectiveness of the regimes heavily depends on the great power's commitment to the regimes. In the case of the WMD nonproliferation regimes, the great power manipulates regime effectiveness to seek their freedom of behavior, economic interests, and technology monopoly. If the great power wishes to strengthen regime effectiveness, it may offer to provide economic or technical incentives to initiate a bargain with regional powers, a process that essentially spreads to the convention and promotes its acceptance by more states. In other words, the birth, change, development, and death of WMD nonproliferation regimes heavily depend on determinants that alter the level of the great power's commitment. These determinants are i) D1: nonrestraint, ii) D2: economic interests, iii) D3: bargaining, and iv) D4: the technology gap. (See Table 1)

The first determinant, D1, is the most powerful determinant among the four determinants. Gundlupet also recognized D1 as one of the three essential conditions required to garner support from the great power. D1 can be observed in the CWC, whereas cannot be seen in the BWC. The U.S aims to maintain its hegemonic status in the life science industry. To develop vaccines and remedies for harmful biological agents, it is inevitable to conduct experiments explicitly forbidden and regulated by the BWC. The strongest determinant found in the four case studies is D1, nonrestraint, which never imposes a stumbling block on the great power's freedom of behavior. D2, economic interest, is another important determinant of the great power's commitment. However, the U.S. support to the CWC contributes to economic interests by helping lower the maintenance cost for storage facilities. In contrast, the United States is highly unlikely to support the BWC as it undermines national economic interests, interests such as protecting the life science industry and ensuring its security.

D3, the bargaining part of the determinants, also presents an important notion regarding regime effectiveness. It is one of the three conditions that Gundlupet recommended as well. For example, the U.S. has a history of providing compensation to the states that relinquished their WMD programs. This pattern can be observed in the CWC. On the contrary, the bargaining can hardly be found in the BWC. Regional powers do not find it palatable to allow the U.S. to improve its own nuclear weapons and allow for it to maintain a monopoly status within the biological industry. This discord and absence of bargaining between states weakens regime effectiveness.

D4, the technology gap, is a determinant that no one has suggested so far. While studying relevant cases, I have discovered that a wider technology gap discourages the great power's commitment to the regime. The technology gap in the chemical science field is narrower than that of biological science. A narrow gap of technology contributes to enhancing regime effectiveness because implementing the regime can render undesired side effects such as weakened

<Table 1> Comparative Analysis

Determinants	CWC	BWC
D 1. Nonrestraint: The Regimes never impose serious restraint on the great power's freedom of the behaviors.	Yes	No
	· U.S, and U.S.S.R tried to establish bilateral treaty and extend it to multilateral treaty (Designed not to be restrained)	· U.S. is seriously restrained by the BWC (Dual use of the Bio-Science, Security Concerns)
D 2. Economic Interests: The Regimes never impose serious restraint on the great power's seeking economic interests.	Yes	No
	· Save maintenance cost for old production and storage facilities for chemical weapons	· U.S. seeks economic interests by maintaining dominance position in the Bio-Science · Industrial Security can be leaked to the competing States
D 3. Bargaining: The Bargaining established between the great power and regional powers	Strong	No
	· The Great power provided cooperative threats reduction fund	· No bargaining can be seen (Discord between the U.S and the E.U, Russia and Iran)
D 4. Technology Gap: Technology gap is narrow between the great power and regional powers. (No Industrial security concerns)	Narrower	Wider
	· Narrow gap in the chemical industry between the U.S. and other regional powers.	· Wide gap in Bio-Science (Industrial security concerns exists)
	⇓	⇓
Result	**Success**	**Failure**
Regime Success Or Failure?	· Destruction for 98% of the Existing chemical weapons (Novel Peace Prize in 2012)	· No agreed verification protocol and It is depending on national implementation measures

Author's note: This is a summary of findings regarding four determinants of the great power's commitment for regime effectiveness. Source Park Ki-Chul, "An Inquiry for Weapons of Mass Destruction Nonproliferation Regime Effectiveness: Great Power's Commitment and Implication for North Korea's Biological Weapons Threats," Ph.D. Dissertation, Korea Univ. Feb. 2021. p. 123

industrial security and leaking secrets. It means that the state party that possesses advanced technology compared to others may have its classified technology stolen. The U.S. has more to lose than other states during on-site inspections or data exchanges. The technology gap is narrower in the CWC than in the BWC. Therefore, the regime effectiveness of the CWC is higher than that of BWC.

In summary, the regime effectiveness is likely to increase when the great power's freedom of behaviors is not regulated. The regime effectiveness is further likely to increase when great powers compensate regional powers for complying

with the regime. The determinants can be rank-ordered by weight as follows: D 1 > D 3 > D 4 > D 2.

VI. Implication on Korean Peninsula

The unilateral policy of the U.S. towards the international regime, based upon military dominance, has the potential to change its course under the leadership of Joe Biden. Given that the American populace chose a seasoned statesman over Trump, the world is expected to return to a predictable one where multilateral and diplomatic dividends are considered valuable. Perhaps most importantly, president Biden is no stranger to multilateralism and diplomacy; his long political career has placed him at the center of U.S. foreign policy. The U.S. has been at the forefront of the strongest assault on global multilateralism since 2017, and this is perhaps the strongest assault the United Nations has faced in its seventy-five year history. A new administration under Biden is poised to usher in the next phase of an experiment in which the United States adapts itself to a changing world. The Trump administration conducted the first phase of this shift with a forceful and at times coarse drive at times to revise the narrative that dominated the post–Cold War world. Throughout the Trump presidency, the U.S. shifted to a definitively self-centric stance, a course of action that led to both surprise and adaptation. As the new Biden administration is ushered into, perhaps, the next phase of the United States' diplomatic journey that can lead to a more cooperative stance.

The next phase of the U.S. and its shift coincides with an epoch where international cooperation is dire. Multinational collaboration is urgently needed to prevent the spread of COVID-19, and Joint Comprehensive Plan of Action (JCOPA) from which The Trump administration withdrew itself will go out of effect in 2025, allowing Iran to rebuild nuclear weapons. Under this complex situation, the U.S. leadership is put to the test again. The Biden administration has the potential to deal with both nuclear and CB threats in a single package in the WMD issue, which offers a chance to empower multilateralism. In this context, the BWC should function as designed to monitor and comply with the implementation clauses of the convention. The Trump administration's staunch stance against multilateralism only worked to North Korean advantage. The administration's indifference regarding the BWC only weakened the regime and its capabilities, thereby creating a situation upon which North Korea utilized to conceal its biological weapons program.

However, there are hopeful prospects that this will no longer serve under the new administration. President Joe Biden named Ron Klain, a veteran Democratic operative and a decades-long confidant, to be his White House chief of staff. As a lawyer with formidable experience on Capitol Hill spanning from advising

President Barack Obama to counseling corporate boardrooms, Klain served as Biden's chief of staff when he was vice president and was the likeliest choice to manage his team in the White House. He was particularly critical of Trump's handling of the coronavirus pandemic, having served as the "Ebola czar" under Obama during an outbreak of the deadly disease in Obama's second term of office. A video of Klain lecturing Trump about the pandemic was widely seen during the campaign. Ron Klain answered the question "what can the next U.S. president do to prepare for the coming pandemic?"[32)]

First, the U.S. president must finish the undertaken work regarding WHO reforms and build a multilateral response force, keeping in mind that the Ebola epidemic became an epidemic largely because of the failure of global health institutions. Chiefly among them is the WHO, which sounded the alarm about the outbreak too late and failed to develop a coherent plan to respond to the outbreak. In a chain of events, the WHO, then, failed to mobilize the key actors to make the response function. Outrage over such failures led to a demand to reform the WHO. However, as WHO's mediocre performance on Zika suggests, the organization is far from being whole. As Ebola fades from the news, however, the pressure on WHO and its bureaucracy to reform will likely fade. Klain argues that the next U.S. president cannot let that happen: he or she must make the WHO reform a priority of the Administration at the UN, at international gatherings, and at all WHO executive committee meetings. The WHO will never have an effective quasi-military capacity to deploy its staff to where epidemic outbreaks happen. Thus, the Biden administration must work with the U.S. and its EU allies to create a global "white helmet" battalion that can enter areas where U.S. troops cannot to contain diseases and stabilize affected areas. This idea is being advanced by Germany, and it deserves strong support from the U.S.

Second, there is a dire need for a global system designed to rapidly determine which new vaccines and treatments are safe to use and to compensate any patients injured by the side effects. America is fortunate to have the world's foremost infectious disease research institution, the National Institute of Allergy and Infectious Diseases, led by incomparable Anthony Fauci. However, its work matters little and less if there is no global process to have new vaccines and treatments tested promptly, approved, and administered to the populace. During the 2009 H1N1 flu epidemic, thousands of doses of vaccines sat in warehouses due to a lack of an internationally accepted process to approve and administer new vaccines and to compensate individuals who may be affected by its side effects.

Similar problems required a series of ad hoc solutions during the Ebola epidemic. Promising vaccines and therapeutics had to be administered as part of

32) Ron Klain, "Confronting the Pandemic Threat," Democracy, A journal of Ideas, Spring 2016. No. 40: https://democracyjournal.org/magazine/40/confronting-the-pandemic-threat/ (Retrieved on 1st Dec 2020)

clinical trials as the world lacked a system to authorize and fund the universal administration of these medicines. Furthermore, there were heated disputes over whether any person injured by these medicines and their side effects could receive compensation. At this point, it is necessary to mention Gavi, a global public-private vaccine alliance, facilitates millions of vaccinations each year without the aforementioned structures. However, its work mainly applies to well-established vaccines—very different from the sort of unproven, hurriedly developed vaccines and treatments that will be needed in the event of a new epidemic such as Zika and others unfound. Now is the time for the world to come together and determine how to approve new vaccines and treatments rapidly, set appropriate risk parameters, pay for such efforts, and compensate any persons injured.

Third and perhaps most importantly, the Biden administration must fund for President Obama's Global Health Security Agenda (GHSA) to continue. President Obama launched GHSA in 2011 to aid countries, primarily located in Africa and Asia, to build up their epidemic detection, treatment, and response capacities. The 2014 Ebola Supplemental Appropriations bill included a substantial boost of support for the GHSA, but the journey is ongoing. The Biden administration must continue the work to create an "African CDC" so the nations in the continent are not dependent on a CDC, which is a continent apart, to identify and track infectious disease outbreaks. Ultimately, the only way to prevent a horrific epidemic on American shores is to build national public health capacities in other countries where the threat is likely to emerge. Expanding the GHSA to additional countries and speeding up its timetable for action in the most vulnerable countries must be a critical action item for the next U.S. President.[33)]

This is a strong signal to awaken the sleeping beauty, the BWC. This can be great momentum for the BWC to revitalize its roles and responsibility to restore the lost 30 years. The United States' return to multilateralism is increasing the likelihood of its support for the BWC. Additionally, it implies responding to North Korea's biological weapons threats. As aforementioned, North Korea is perhaps the greatest beneficiary of the ineffective BWC regime as the United States kept mum about North Korea's biological weapon threats. Recently, suspected North Korean hackers have attempted to break into the system of British drugmaker AstraZeneca as the company raced to deploy its vaccine for COVID-19. The hacking attempts targeted a 'broad set of people' including staff working on COVID-19 research but are not thought to have been successful.[34)] Though

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33) Ron Klain, "Confronting the Pandemic Threat," Democracy, A journal of Ideas, Spring 2016. No. 40: https://democracyjournal.org/magazine/40/confronting-the-pandemic-threat/ (Retrieved on 1stDec2020)

34) Jack Stubbs, "Exclusive: Suspected North Korean hackers targeted COVID vaccine maker AstraZeneca-sources," Reuters, 27 November 2020

unsuccessful, it is worrisome that any successful attempts in the future can help North Korea develop variant biological weapons because of dual-use nature of bio-science. Against North Korea's biological weapons threats, Seoul must prepare a two-track approach that consists of prevention and mitigation. First, prevention efforts should be integrated and embedded into the BWC with other regimes such as AG, PSI, and UNSCR 1540 committee. Second, mitigation efforts should be prepared to respond to biological incidents including naturally emerging infectious diseases with a full spectrum of capabilities. Such responses include i) alarming, ii) detection and diagnosis, iii) decontamination, and iv) consequence management. Consequence management, especially, will require cooperation of inter-government agencies.

VII. Conclusion

In the field of the global WMD regimes where cooperation is expected to actively occur, the fact that the great power's commitment to the regime determines the regime effectiveness uncovers the logic of power politics. However, the United States' return to multilateralism is a notable milestone in the journey to recover the lost 30 years of the BWC. In this context, readers of this study will be able to find the direction towards which the WMD nonproliferation regime should lean. In the coming future, it is predicted with certainty that the emergence of new pandemics and the threat of biological weapons on the Korean peninsula will increase. In light of this outlook, Washington should assume a role of a leading state in preventing future biological disasters and protecting lives when the crisis happens. The U.S. silence on the BWC provides a shadow under which potential biological weapons states including North Korea can thrive.

Considering the lessons learned from COVID-19 pandemics, the Biden administration must provide the necessary support for strengthening the regime effectiveness of the BWC and enhance international cooperation for global health security. First, Washington must establish an active policy for the BWC regarding its verification protocol, Articles VII and X. Second, the Nuclear Security Summit, initiated by the Obama administration, must be extended into a WMD security Summit and made to deal with biological and chemical weapons threats. Third, the U.S. should play a key role in leading the GHSA to enhance countries' capacities to prevent, detect, and respond to infectious diseases by sharing technologies for biological security and safety.[35)]

As examined throughout this study, the effectiveness of WMD nonproliferation

35) Park Ki-Chul, "An Inquiry for Weapons of Mass Destruction Nonproliferation Regime Effectiveness: Great Power's Commitment and Implication for North Korea's Biological Weapons Threats", Ph.D. Dissertation, Korea Univ. Feb. 2021. p. 144

regimes largely depends on the great power's military dominance and determination to commit. However, the global community must act upon this status quo and seek a return to multilateralism with 'enlightened selfishness.' Three decades ago, few people expected the success of the CWC. Today, the CWC is praised as one of the most successful cases in the global security regime. If actors and scholars alike remain silent regarding the BWC in this critical momentum, the BWC will not only lose three but perhaps five decades or even a century. The consequences of this silence—a future where the threat of biological weapons and killer-diseases is looming and perpetual—will become another burden that the next generation will have to face.

[Received: November 01, 2021; Revised: January 25, 2022; Accepted: March 08, 2022]

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