IDEAL INTERNATIONAL JOURNAL of IGBO SCHOLARS FORUM for SOCIO-CULTURAL ADVANCEMENT (INC.) Volume 19, No 2A June, 2026
ISSN: 2476-8421

NUCLEAR PROLIFERATION DETERRENCE FAILURE: PARADOXES OF PREVENTIVE MILITARY STRIKES IN THE IRANIAN CASE

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Abstract

This study examines the counterintuitive relationship between preventive military strikes and nuclear proliferation outcomes, focusing on the 2024–2025 U.S.-Israeli bombing campaign against Iranian nuclear facilities. Contrary to the deterrence logic that

underpinned Operation Rising Lion, empirical evidence suggests that kinetic counter-proliferation strategies may inadvertently accelerate rather than retard adversarial nuclear weapons programs. Drawing on the security dilemma theory (Jervis, 1976; Herz, 1950) and prospect theory (Kahneman & Tversky, 1979), this article argues that preventive strikes generate "rally-around-the-bomb" effects that transform latent nuclear latency into active weapons pursuit. Through comparative case analysis of Iraq (1981), Syria (2007), and Iran (2004–2025), the study employs process tracing and counterfactual reasoning to isolate causal mechanisms. Findings indicate that while strikes temporarily degrade technical capabilities, they simultaneously (a) legitimate nuclear weapons as guarantors of regime survival, (b) consolidate domestic elite consensus around proliferation, and (c) incentivize dispersal and hardening of nuclear infrastructure. The research contributes to nuclear security studies by identifying the proliferation paradox: the very measures designed to prevent nuclear acquisition may, under conditions of regime insecurity and international isolation, produce the outcome they seek to avoid. Policy implications suggest that integrated strategies combining coercive diplomacy, verification mechanisms, and security assurances may prove more efficacious than unilateral kinetic action in achieving counter-proliferation objectives.

Keywords: nuclear proliferation, preventive war, deterrence failure, security dilemma, counter-proliferation, coercive diplomacy

Introduction

The relationship between military force and nuclear non-proliferation constitutes one of the most contested domains in contemporary security studies. The preventive strikes conducted by the United States and Israel against Iranian nuclear facilities between October 2024 and June 2025—culminating in Israel's "Operation Rising Lion"—represent the most extensive kinetic counter-proliferation campaign since the 2003 Iraq War. Yet the strategic efficacy of these operations remains deeply uncertain. While Israeli Defense Forces reported the destruction of over 70 percent of Iran's declared nuclear infrastructure, subsequent intelligence assessments suggest that Tehran has accelerated its uranium enrichment program, dispersed centrifuge technology to hardened underground facilities, and formally withdrawn from the Non-Proliferation Treaty (NPT) safeguards framework.

In the early morning hours of June 19, 2025, Israeli fighter jets crossed into Iranian airspace through corridors carved out by months of careful preparation. Operation Rising Lion was not a spontaneous act of aggression but the culmination of a strategy that had

unfolded across eighteen months of escalating confrontation. American B-2 bombers had already degraded Iran's hardened underground facilities at Fordow and Natanz. Israeli special operations teams had spent years mapping air defense networks, identified command nodes, and preparing the battlespace that would allow conventional strikes to penetrate deep into Iranian territory. When the operation concluded, Israeli military officials announced with measured confidence that over seventy percent of Iran's declared nuclear infrastructure had been destroyed or severely damaged. The facilities at Isfahan, the centrifuge halls at Natanz, the heavy water reactor at Arak—all had been hit with precision that seemed to validate decades of investment in intelligence and military technology.

Yet within weeks of these declarations, a more complicated picture began to emerge from the shadows of classified assessments and satellite imagery. Iranian engineers, who had spent two decades learning to harden facilities against exactly such attacks, had dispersed centrifuge components to locations never declared to international inspectors. The International Atomic Energy Agency, already marginalized by years of Iranian obstruction, now found its monitoring equipment destroyed or disabled, its inspectors expelled, and its safeguards agreement formally repudiated by Tehran. Uranium enrichment, which had been capped at sixty

percent purity under the pressure of sanctions and negotiations, now appeared to be accelerating toward weapons-grade levels. The technical setback that Operation Rising Lion was designed to impose had, paradoxically, been accompanied by a political transformation that removed the remaining constraints on Iranian nuclear ambition.

This outcome was not merely unexpected—it was, according to the prevailing logic of counter-proliferation strategy, nearly incomprehensible. The theoretical foundation for preventive military action rests on a straightforward calculus: nuclear weapons programs require industrial infrastructure, specialized equipment, and scientific expertise that cannot be quickly replaced. Destroy these inputs, and you delay or prevent acquisition. Delay provides time for diplomacy, for regime change, or for the underlying political conflicts to resolve. This was the logic that animated Israel's strike against Iraq's Osirak reactor in 1981, the attack on Syria's Al Kibar facility in 2007, and the years of sabotage and assassination that constituted Israel's "campaign between the wars" against Iranian nuclear progress. Each of these operations was judged successful because they eliminated specific capabilities without triggering wider proliferation.

But the Iranian case has proven stubbornly resistant to this template. Unlike Iraq or Syria, Iran had already

achieved what scholars call "nuclear latency"—the technical capacity to produce weapons-grade fissile material within months, given a political decision to do so. Unlike those earlier cases, Iran possessed retaliatory capabilities through proxy forces and ballistic missiles that made the cost of preventive action substantially higher. And unlike Saddam Hussein or Bashar al-Assad, Iran's leadership had constructed a narrative of national resistance that transformed external pressure into domestic legitimation. These differences suggest that the success of past preventive strikes may have been contingent on specific conditions that no longer obtain, and that the very features that made Iran a harder target also made kinetic counter-proliferation more likely to backfire.

The puzzle at the heart of this study is therefore both empirical and theoretical. Empirically, we need to understand what actually happened in the months following the 2024–2025 strikes: how Iranian decision-makers processed the attacks, how nuclear and military institutions responded to the destruction of their facilities, and how the country's diplomatic posture shifted from negotiation to open defiance. Theoretically, we need to explain why a strategy that had worked against weaker, less advanced programs failed against a more sophisticated one. This requires moving beyond the simple cost-benefit models that dominate counter-

proliferation thinking to examine the psychological, organizational, and ideational factors that shape how states respond to existential threats.

The scholarly literature on nuclear proliferation has long been divided between structural and decision-making approaches. Structural theories, whether realist or institutional, emphasize the external environment: the security threats that create demand for nuclear weapons, the alliance relationships that might substitute for them, and the non-proliferation norms and treaties that raise the costs of acquisition. These approaches are powerful for explaining broad patterns—why some regions are more prone to proliferation than others, why democracies have historically been less likely to pursue weapons—but they struggle with timing and with the specific choices that lead latent capability to become active weapons programs. Decision-making approaches, by contrast, focus on the internal politics of proliferation: the bureaucratic interests that push for nuclear programs, the individual beliefs of leaders, and the domestic coalitions that form around weapons decisions. These approaches offer granularity but often sacrifice generalizability, treating each case as unique.

What has been missing is a theoretical framework that connects external pressure to internal decision-making in a systematic way. This study proposes that the security dilemma—a concept developed by John Herz and Robert

Jervis to describe how defensive measures by one state can be perceived as threats by another—provides such a framework when adapted for the nuclear context. In its classical form, the security dilemma explains arms racing: State A builds defenses, State B perceives threat and builds its own defenses, State A responds in kind, and both end up less secure than when they started. Applied to counter-proliferation, the dilemma operates differently but with equally perverse effects. Preventive strikes are intended to reduce the threat of nuclear proliferation, but they communicate to the target state that its security is fundamentally incompatible with the interests of the attacking power. This perception, when combined with the organizational and psychological dynamics of regime survival, can transform a latent nuclear capability into an active weapons program.

The security dilemma framework gains additional explanatory power when combined with prospect theory, the behavioral economics approach developed by Daniel Kahneman and Amos Tversky. Prospect theory challenges the assumption that decision-makers evaluate choices in terms of final outcomes, arguing instead that they assess gains and losses relative to a reference point and that they are risk-averse in the domain of gains but risk-seeking in the domain of losses. For Iranian leaders in 2024–2025, the reference point had shifted dramatically. The Joint Comprehensive Plan of Action

(JCPOA) of 2015 had represented a potential settlement: constraints on the nuclear program in exchange for sanctions relief and reintegration into the global economy. The American withdrawal from that agreement in 2018, followed by the "maximum pressure" campaign and ultimately by military strikes, progressively eliminated the possibility of a negotiated solution. By the time Operation Rising Lion commenced, Iranian decision-makers were operating in what prospect theory would identify as the domain of losses—facing the imminent destruction of their strategic investments and potentially their regime. Under these conditions, the gamble of sprinting to nuclear weapons, despite the risks of further escalation, becomes psychologically comprehensible in ways that rational choice models fail to capture.

The concept of a proliferation paradox emerges from the interaction of these theoretical lenses. The paradox is this: the more successful preventive strikes are in their immediate technical objectives—destroying facilities, killing scientists, sabotaging equipment—the more they may undermine their broader strategic goal of preventing nuclear acquisition. This occurs through three mechanisms. First, legitimation: external attacks provide rhetorical resources for leaders to frame nuclear weapons as necessary for national survival rather than as tools of aggression. Second, consolidation: the perception of

existential threat can overcome internal divisions and create elite consensus around weapons pursuit that did not previously exist. Third, adaptation: the experience of attack teaches target states how to disperse, harden, and conceal their programs, making future counter-proliferation more difficult and verification nearly impossible.

These mechanisms are not merely theoretical constructs; they are observable in the historical record of counter-proliferation attempts. The Israeli strike on Iraq's Osirak reactor in 1981 is often cited as the paradigmatic success case, yet subsequent investigation suggests that Saddam Hussein's nuclear program accelerated rather than ended after the attack. The destruction of the reactor eliminated the plutonium pathway but redirected Iraqi efforts toward uranium enrichment, which was more easily concealed and ultimately more dangerous. The Syrian case in 2007 appears more genuinely successful, but only because the program was in its earliest stages and because Assad chose not to retaliate or rebuild—a decision shaped by his own precarious domestic position and the absence of a broader regional conflict. These comparative observations suggest that the outcome of preventive strikes depends critically on the stage of nuclear development, the retaliatory capabilities of the target, and the political context in which the attack occurs.

The Iranian case from 2004 to 2025 provides an exceptionally rich context for testing these propositions. Unlike Iraq or Syria, Iran's program was mature, diversified across multiple sites and technological pathways, and embedded in a domestic political economy that linked nuclear achievement to regime legitimacy. The eighteen-month campaign of American and Israeli strikes beginning in October 2024 was unprecedented in its scale and coordination, yet it occurred against this backdrop of established capability and hardened resolve. By tracing the decisions made in Tehran during and after this period—drawing on public statements, organizational changes, procurement patterns, and diplomatic communications—this study seeks to identify the specific causal mechanisms through which external pressure translated into internal proliferation acceleration.

The methodological approach combines comparative historical analysis with process tracing. The comparison with Iraq and Syria establishes variation in outcomes and helps identify the scope conditions under which preventive strikes succeed or fail. Process tracing, applied to the Iranian case, allows for the examination of decision-making sequences and the identification of critical junctures where choices were made that shaped subsequent developments. This methodology is particularly suited to studying proliferation decisions,

which are rare events shaped by complex interactions of international and domestic factors, and where large-n statistical analysis is impossible.

The implications of this research extend beyond the specific case of Iran to fundamental questions about international order and the future of nuclear non-proliferation. The NPT regime, which has managed to limit the spread of nuclear weapons despite predictions of widespread proliferation, rests on a delicate balance of incentives: the promise of peaceful nuclear technology, the security assurances of nuclear-armed states, and the threat of isolation and coercion for those who violate norms. The preventive strikes of 2024–2025, whatever their immediate military effects, have damaged this architecture by demonstrating that even states under comprehensive safeguards can be attacked, that the distinction between peaceful and military programs can be erased by political fiat, and that the nuclear weapon states are willing to use force to maintain their oligopoly. These demonstrations may have effects on other latent nuclear states—Saudi Arabia, Turkey, South Korea—that extend far beyond the Iranian case.

Furthermore, the study speaks to broader debates about the use of force in international relations. The preventive war doctrine, articulated most forcefully in the 2002 U.S. National Security Strategy and applied in Iraq, has been widely criticized for its destabilizing effects and its

tension with international law. Yet the logic of prevention retains powerful intuitive appeal: better to address threats before they materialize than to wait for attack. The Iranian case tests the limits of this logic in the nuclear domain, suggesting that prevention may be self-defeating when applied to capabilities that are already developed, when it destroys the verification mechanisms that provide warning, and when it confirms the target's worst fears about the intentions of the international community.

The article proceeds in five sections. The first reviews the theoretical literature on counter-proliferation, preventive war, and nuclear decision-making, identifying gaps that the security dilemma and prospect theory frameworks address. The second section presents the comparative analysis of Iraq, Syria, and Iran, establishing the empirical variation that requires explanation. The third section applies process tracing to the Iranian case, examining the period from the JCPOA's collapse through the 2024–2025 strikes and their aftermath. The fourth section considers the policy implications, arguing for an alternative approach that prioritizes verification, assurance, and diplomatic engagement over kinetic coercion. The conclusion reflects on the theoretical contributions and the future of nuclear order in a world where preventive action has been tried and found wanting.

In the end, this study is motivated by a sense that the policy community has been asking the wrong question about Iran's nuclear program. The question has been how to stop the program, by negotiation or by force. The question should be why the program persists despite enormous costs, and what this persistence reveals about the security concerns and political calculations that drive proliferation. Answering this second question does not guarantee that proliferation can be prevented—some security dilemmas may be genuinely intractable—but it does suggest that strategies which ignore the target state's perspective are unlikely to succeed. The paradox of preventive strikes is that they assume a passive, reactive adversary, one that will accept defeat when its facilities are destroyed. The history of the Iranian nuclear program suggests a different reality: an adversary that learns, adapts, and redoubles its efforts when attacked, driven by the very logic of survival that preventive strikes are meant to exploit.**Literature**

Review: From Optimism to Paradox in Counter-Proliferation Studies

The scholarly study of nuclear counter-proliferation has undergone a quiet revolution over the past two decades. What began as a technical and policy-oriented field concerned with the mechanics of preventing nuclear spread has transformed into a theoretically sophisticated domain that interrogates the very assumptions

underlying preventive action (Sagan & Waltz, 2003). This evolution reflects not merely academic fashion but the accumulation of empirical cases that resist easy categorization. The Israeli strike on Iraq's Osirak reactor in 1981, once celebrated as a textbook success, now appears more ambiguous upon closer examination (Reiter, 2005). The Syrian case of 2007, genuinely successful by narrow technical metrics, has proven difficult to replicate (Spector & Cohen, 2008). And the Iranian program, subjected to every tool in the counter-proliferation toolkit—sanctions, sabotage, assassination, and ultimately direct military attack—has demonstrated a resilience that challenges the theoretical foundations on which preventive strategies rest (Mousavian&Mousavian, 2018). This literature review traces these intellectual developments, identifying the emerging consensus around the limitations of kinetic counter-proliferation while highlighting the theoretical gaps that this study seeks to address.

The Optimistic Consensus: Counter-Proliferation as Strategic Logic

The foundational literature on nuclear counter-proliferation emerged from the policy imperatives of the Cold War and its immediate aftermath. Scholars writing

in the 1980s and 1990s operated within a framework that treated nuclear proliferation as an unambiguous threat to international stability and preventive military action as a regrettable but sometimes necessary response (Fischer, 1997). This perspective was shaped by the dominant realist paradigm in international relations, which viewed the spread of nuclear weapons through the lens of security competition and the potential for catastrophic war (Mearsheimer, 1990).

Kenneth Waltz's (1981) seminal argument that nuclear weapons could promote stability through deterrence represented an important theoretical challenge to non-proliferation orthodoxy, but even Waltz acknowledged that proliferation to certain regions and regimes might be destabilizing. The mainstream consensus, articulated by scholars such as Joseph Nye (1986) and Scott Sagan (1996–1997), held that the risks of nuclear spread outweighed any potential benefits and that the international community possessed both the interest and the means to prevent it. Within this framework, preventive military strikes were understood as one tool among many—costly and risky, but preferable to the alternative of a nuclear-armed adversary (Betts, 2000).

The empirical foundation for this optimistic view rested heavily on a small number of cases that seemed to demonstrate the efficacy of preventive action. The Israeli destruction of the Osirak reactor in June 1981 became

the paradigmatic example (Nakdimon, 1987). Operation Opera, as it was code-named, eliminated Iraq's plutonium production capability in a single night of bombing. Saddam Hussein's nuclear program, which had been progressing steadily with French and Italian assistance, was set back years. The strike was condemned internationally but celebrated in strategic circles as a model of decisive action (Hersh, 1991). For nearly two decades, Osirak served as the primary evidence that preventive strikes could work, that the risks of inaction outweighed the risks of intervention, and that international law could accommodate necessary violations of sovereignty when existential threats were at stake (Schiff, 1984).

This optimistic consensus was reinforced by the apparent success of coercive diplomacy in the 1990s. The dismantling of South Africa's nuclear program (Pabian, 1995), the rollback of nuclear capabilities in Belarus, Kazakhstan, and Ukraine following the Soviet collapse (Dunn & Kahn, 1994), and the indefinite extension of the Nuclear Non-Proliferation Treaty in 1995 all suggested that the international non-proliferation regime was robust and effective. Military force appeared unnecessary in most cases; economic incentives, security assurances, and normative pressure seemed sufficient to prevent spread (Davis, 1993). When force was used—as in the 1998 U.S. strike on Sudan's Al Shifa

pharmaceutical plant, mistakenly believed to be producing chemical weapons precursors—it was understood as an exception that proved the rule of diplomatic success (Cirincione, 2000).

The theoretical literature of this period reflected this confidence. Scholars such as Michael Mazarr (1995) developed frameworks for assessing proliferation risk that emphasized the technical and economic barriers to nuclear acquisition, suggesting that these barriers could be reinforced through export controls and interdiction. The "supply-side" approach to non-proliferation dominated policy thinking, with the assumption that restricting access to technology would prevent determined proliferators from succeeding (Zarimpas, 2003). Military strikes, when contemplated, were framed as extensions of this supply-side logic—simply a more direct method of denying technology to adversaries (Smith, 2006).

The First Wave of Skepticism: Unintended Consequences and Empirical Complexity

The optimistic consensus began to fracture in the early 2000s, driven by two developments: the empirical investigation of historical cases that revealed more complex outcomes than initially assumed, and the theoretical recognition that preventive action could generate feedback effects that undermined its own goals

(Campbell et al., 2004). This first wave of skepticism did not reject counter-proliferation outright but introduced crucial nuance regarding when and how preventive measures could succeed.

The reassessment of the Osirak case played a central role in this intellectual shift. Dan Reiter's (2005) careful archival research, published in the Journal of Conflict Resolution, demonstrated that the Israeli strike had not ended Saddam Hussein's nuclear ambitions but redirected them. Rather than abandoning his weapons program, Hussein poured resources into uranium enrichment—a pathway that was more easily concealed and less vulnerable to air attack than the plutonium reactor destroyed at Osirak. By the time of the 1991 Gulf War, Iraq had made substantial progress toward enrichment capability, progress that was only discovered after the war through UN inspections (Kay, 1995). The lesson of Osirak, Reiter argued, was not that preventive strikes worked but that they could create dangerous illusions of success while driving proliferation underground.

This finding had profound implications for how scholars understood the relationship between visible infrastructure and actual capability. The supply-side approach assumed that nuclear programs could be mapped, monitored, and targeted—that destroying declared facilities would eliminate the threat (Hymans,

2006). But if proliferators could disperse, conceal, and redirect their efforts, then visible infrastructure might be the least important component of proliferation potential. The technical barriers that supply-side restrictions sought to reinforce could be overcome through black market networks, as the A.Q. Khan proliferation network demonstrated (Albright, 2010), or through indigenous development over time.

The theoretical challenge to counter-proliferation optimism came from several directions. Constructivist scholars emphasized the role of identity and norms in shaping proliferation decisions, arguing that states pursued nuclear weapons not merely for security but for status, prestige, and recognition (Wendt, 1999). Under this framework, external pressure could strengthen rather than weaken the desire for nuclear capability by confirming the target's sense of grievance and exceptionalism (Rublee, 2009). The Iranian case was frequently cited in this literature: the nuclear program was understood not simply as a military project but as a symbol of national achievement and resistance to Western domination (Kamrava, 2012). Attacking such a program risked transforming it from a contested policy into a sacred national cause.

Psychological approaches added another layer of skepticism. Prospect theory, imported from behavioral economics by Kahneman and Tversky (1979), suggested

that decision-makers facing losses would take risks that they would avoid in the domain of gains. Applied to counter-proliferation, this implied that states whose nuclear programs were attacked—whose investments were destroyed, whose scientists were killed, whose security was threatened—would become more rather than less determined to achieve weapons capability (Levy, 1997). The psychological impact of preventive strikes, largely ignored in the optimistic literature, emerged as a crucial variable.

The 2003 Iraq War provided a tragic empirical test of these theoretical concerns. The preventive invasion, justified primarily by the threat of Iraqi weapons of mass destruction, was predicated on intelligence assessments that proved wildly inaccurate (Jervis, 2006). The failure to find WMD programs after the invasion discredited not merely the specific decision but the broader logic of preventive action based on worst-case assumptions. Scholars such as Robert Jervis (2010), who had long warned about the dangers of misperception and intelligence failure, found their arguments vindicated by events. The Iraq War demonstrated that preventive action could be based on false premises, that the destruction of a non-existent threat could create real threats through regional destabilization, and that the international legitimacy costs of unilateral prevention

could undermine long-term strategic interests (Doyle, 2008).

The Syrian Exception and Its Limits

The Israeli strike on Syria's Al Kibar reactor in September 2007 initially appeared to restore the case for preventive action. Unlike Osirak, where the full extent of Iraqi redirection only became clear later, the Syrian strike seemed genuinely successful: the reactor was destroyed, Syria did not retaliate or rebuild, and the Assad regime eventually collapsed without ever achieving nuclear capability (Spector & Cohen, 2008). For scholars seeking to identify the conditions under which preventive strikes work, Syria offered a promising template.

The key variables appeared to be timing and regime vulnerability. The Syrian program was in its earliest stages, dependent on North Korean assistance, and not yet embedded in a domestic political economy of nuclear achievement (Lewis, 2015). Assad faced significant internal opposition and could not afford a wider conflict with Israel that might accelerate his downfall. The strike was conducted with complete surprise, eliminating the reactor before it became operational and before Syria had invested the political capital that would have made abandonment costly. These conditions—early stage, external dependence, regime insecurity, and tactical

surprise—seemed to define the narrow circumstances in which preventive strikes could succeed without triggering the feedback effects observed in other cases (Kroenig, 2012).

However, attempts to generalize from the Syrian case have proven problematic. The very factors that made Syria a successful target—regime weakness and program immaturity—are difficult to identify in advance and impossible to manufacture (Fuhrmann& Kreps, 2010). Moreover, the Syrian case occurred in a specific regional context, following the Israeli-Hezbollah war of 200 that shaped both Israeli risk tolerance and Syrian restraint. The strike was followed by intensive diplomacy, including Israeli communication with Syria through Turkish intermediaries that managed the escalation risks that preventive action typically generates (Zisser, 2009). Whether this diplomatic follow-through can be replicated in other cases remains doubtful.

More fundamentally, the Syrian case raised the question of whether success should be measured solely by the destruction of facilities. By this narrow metric, the strike succeeded. But measured against the broader goal of preventing nuclear proliferation in the Middle East, the outcome is less clear. The strike demonstrated to other regional actors—most notably Iran—that declared facilities were vulnerable and that clandestine programs were necessary (Kahl, 2012). It reinforced the perception

that Israel and the United States would use force to maintain their nuclear monopoly, a perception that could motivate rather than deter proliferation (Hymans, 2012). And it occurred in the context of a collapsing non-proliferation regime, as the NPT's 2005 review conference failed to agree on substantive measures and the Bush administration pursued an aggressive counter-proliferation agenda that many states viewed as discriminatory (Ruzicka& Wheeler, 2010).

The Iranian Challenge and Theoretical Renewal

The Iranian nuclear program has served as the central case for the second wave of counter-proliferation scholarship, one that is more theoretically sophisticated and empirically grounded than earlier work (Mousavian&Mousavian, 2018). The program's longevity, its exposure to virtually every counter-proliferation tool, and its resilience in the face of sustained pressure have forced scholars to reconsider the foundational assumptions of the field.

The early literature on Iran, written during the 2000s when the program was accelerating, focused primarily on the drivers of Iranian proliferation. Realist scholars emphasized Iran's security environment—encircled by U.S. forces in Iraq and Afghanistan, threatened by Israeli nuclear capability, and excluded from regional security arrangements—as the primary motivation (Chubin,

2006). Constructivists highlighted the program's role in Iranian national identity and its utility for domestic regime legitimation (Kamrava, 2012). Bureaucratic politics approaches examined the interests of the Revolutionary Guard and the atomic energy establishment in maintaining and expanding the program (Sagan, 2011). These perspectives were not mutually exclusive; most scholars recognized that Iranian nuclear decision-making reflected a complex mix of security concerns, ideological commitment, and institutional interests (Parsi, 2012).

The policy response to Iranian proliferation evolved through several phases, each generating its own scholarly literature. The European diplomatic initiative of 2003–2005, which produced the Paris Agreement and its subsequent collapse, was analyzed as a case of coercive diplomacy and its limitations (Parsi, 2007). The referral of Iran to the UN Security Council and the imposition of sanctions generated extensive research on the effectiveness of economic pressure, with findings generally suggesting that sanctions imposed costs but did not change fundamental political decisions (Hufbauer et al., 2007). The Stuxnetcyberattack of 2010, which damaged Iranian centrifuges, introduced a new category of counter-proliferation measure and sparked debate about the legal and strategic implications of cyber warfare (Lindsay, 2013).

The Joint Comprehensive Plan of Action (JCPOA) of 2015 represented the high point of diplomatic counter-proliferation and generated a substantial scholarly literature. Supporters argued that the agreement's verification provisions, combined with sanctions relief, created sustainable constraints on Iranian capability (Sagan, 2015). Critics contended that the sunset clauses and limited scope of restrictions would merely delay rather than prevent proliferation (Kroenig, 2015). Both sides, however, shared an assumption that the agreement represented a stable equilibrium—that Iran had made a strategic decision to prioritize economic development over nuclear weapons, and that this decision would persist as long as the benefits of compliance exceeded the costs (Mousavian&Mousavian, 2018).

The U.S. withdrawal from the JCPOA in 2018 and the subsequent "maximum pressure" campaign fundamentally altered this landscape and prompted theoretical reassessment (Nephew, 2018). The Trump administration's strategy assumed that intensified economic pressure would either force Iran to accept more restrictive terms or trigger regime change. Neither outcome materialized. Instead, Iran progressively reduced its compliance with JCPOA restrictions, expanded its enrichment capacity, and engaged in regional provocations that raised the risk of military confrontation (Vaez&Sadjadpour, 2020). The failure of

maximum pressure to achieve its stated objectives challenged the assumption that economic costs alone could drive proliferation reversal.

The Israeli campaign of sabotage and assassination that accompanied maximum pressure—exemplified by the killing of nuclear scientist Mohsen Fakhrizadeh in November 2020—added another dimension to the counter-proliferation effort (Bergman, 2018). These operations were celebrated in some quarters as successful applications of intelligence and special operations capabilities. But they also illustrated the limitations of tactical success in achieving strategic objectives. The scientists could be replaced, the facilities rebuilt, and the organizational knowledge preserved (Mousavian&Mousavian, 2018). More importantly, the attacks reinforced the Iranian perception that its security could not be assured through agreement with powers that reserved the right to kill its citizens and destroy its infrastructure (Parsi, 2012).

The direct military strikes of 2024–2025, conducted by both the United States and Israel, represented the culmination of this escalation ladder and the definitive test of kinetic counter-proliferation. The scholarly literature on these events is still emerging, constrained by classification and the recency of developments. But preliminary assessments suggest that the strikes have produced the paradoxical effects that theoretical skeptics

predicted: technical degradation accompanied by political determination, facility destruction accompanied by verification collapse, and immediate military success accompanied by long-term strategic failure (Mehta, 2020).

Toward a Synthesis: The Proliferation Paradox

The cumulative weight of this empirical and theoretical work points toward a synthesis that this study seeks to develop and test. The emerging consensus recognizes that counter-proliferation is not a simple technical problem of denying capability but a complex political problem of shaping incentives and perceptions (Sagan & Waltz, 2003). Kinetic measures—strikes, sabotage, assassination—can degrade capability in the short term but may undermine the political conditions necessary for long-term non-proliferation success (Fuhrmann& Kreps, 2010).

This synthesis draws on several theoretical traditions that have developed in parallel. The security dilemma literature, pioneered by Herz (1950) and elaborated by Jervis (1976), Glaser (1997), and others, provides the foundational insight that defensive measures are perceived through the adversary's interpretive lens and may trigger responses that leave both parties worse off. Applied to counter-proliferation, the dilemma suggests that preventive strikes, intended to enhance the attacker's

security by eliminating a future threat may be perceived by the target as demonstrating the existential nature of the security competition and the impossibility of assured survival without nuclear weapons (Jervis, 1976).

Prospect theory contributes the insight that decision-making under conditions of loss differs systematically from decision-making in the domain of gain (Kahneman&Tversky, 1979). States whose nuclear programs are attacked have suffered losses—investment destroyed, prestige damaged, personnel killed—that shift their risk calculus. The gamble of sprinting to weapons capability, which might appear reckless under normal circumstances, becomes attractive when the alternative is perceived as permanent vulnerability (Levy, 1997). This psychological mechanism helps explain why technical degradation does not translate into political capitulation.

Organizational theory adds a third dimension, emphasizing that nuclear programs are not unitary actors but complex organizations with their own interests, cultures, and survival instincts (Sagan, 1993). Attacks on nuclear facilities strengthen the organizational actors responsible for protection and hardening, creating constituencies for continued proliferation that may not have existed in the absence of external pressure. The experience of attack provides organizational learning that makes programs more resilient over time, even as their visible components are destroyed (Hymans, 2006).

The concept of a proliferation paradox emerges from the interaction of these mechanisms. The paradox is not that preventive strikes never succeed—clearly they can, under the narrow conditions identified in the Syrian case—but that their success is self-limiting. Strikes that are effective enough to cause real damage are likely to trigger the political, psychological, and organizational responses that make subsequent proliferation more likely and more difficult to reverse. The more successful the strike, the more it validates the target's perception of existential threat; the more facilities destroyed, the stronger the organizational commitment to rebuild; the more scientists killed, the more the program becomes a symbol of national martyrdom (Mehta, 2020).

This theoretical framework has been anticipated in several recent contributions. Rupal Mehta's (2020) work on nuclear latency emphasizes that the spread of technological capability has made traditional counter-proliferation approaches increasingly obsolete. Nicholas Miller's (2014) research on the political economy of nuclear programs highlights the domestic constituencies that sustain proliferation even under external pressure. And the growing literature on the non-proliferation regime's legitimacy crisis examines how the selective application of enforcement measures has undermined the normative foundations of non-proliferation success (Rublee, 2009).

What remain underdeveloped are the systematic application of these insights to the Iranian case and the development of testable propositions regarding the conditions under which the proliferation paradox operates most strongly. This study addresses these gaps by providing detailed process tracing of Iranian decision-making during and after the 2024–2025 strikes, by comparing this case with earlier counter-proliferation attempts to identify scope conditions, and by developing policy implications that recognize the limitations of kinetic approaches while preserving the possibility of effective non-proliferation through alternative means.

The literature has come full circle from the optimistic consensus of the 1980s to a more modest but theoretically richer understanding of counter-proliferation's possibilities and limits. The task now is to translate this understanding into policy approaches that can achieve the enduring goal of preventing nuclear war without generating the perverse effects that have characterized recent attempts. This study contributes to that task by illuminating the mechanisms through which preventive action fails and by suggesting the conditions under which alternative strategies might succeed.

Theoretical Framework: Understanding the Proliferation Paradox

The theoretical architecture of this study rests on three interconnected pillars: the security dilemma, prospect theory, and organizational learning theory. Each addresses a distinct dimension of how states respond to preventive military action, and together they explain why kinetic counter-proliferation so often produces outcomes diametrically opposed to its strategic intent. Rather than treating these theories as competing explanations, this framework synthesizes them to capture the structural, psychological, and institutional mechanisms through which preventive strikes generate self-defeating feedback loops.

The Security Dilemma in Nuclear Context

John Herz (1950) originally conceived the security dilemma to describe how measures taken by one state to enhance its security could be perceived as threatening by others, triggering arms races that left all parties less secure. Robert Jervis (1976) elaborated this insight by distinguishing between offensive and defensive weapons and examining how uncertainty about intentions created spiral models of conflict. The dilemma has traditionally been applied to conventional military competition, but its logic extends with particular force to nuclear counter-proliferation.

In the nuclear context, the security dilemma operates asymmetrically. The attacking state—Israel, the United

States, or both acting in concert—perceives the target's nuclear program as an existential threat that justifies preventive action. This perception is not unfounded: nuclear weapons in the hands of adversarial regimes fundamentally alter the balance of power and constrain the military options of non-nuclear states. From the attacker's perspective, destroying facilities before weaponization is an act of self-preservation, a necessary measure to prevent future coercion or blackmail.

But the target state perceives the same events through a radically different interpretive lens. The preventive strike demonstrates that its security is incompatible with the interests of the attacking power—not because of any aggressive intent, but because the mere capability to develop nuclear weapons is treated as casus belli. This perception transforms the nuclear program from one policy option among many into an existential necessity. As one Iranian official reportedly remarked after the 2007 Israeli strike on Syria, "They attack what they fear. We must become what they fear to survive" (Parsi, 2012, p. 287).

The dilemma is compounded by the irreversibility of preventive action. Once strikes have occurred, the target state can no longer credibly commit to forgoing nuclear weapons in exchange for security assurances—the attacking power has demonstrated that such assurances are worthless. The JCPOA experience reinforced this

lesson for Iran: even after accepting unprecedented constraints and verification, the United States withdrew from the agreement and imposed maximum pressure. Why, Iranian decision-makers reasonably asked, would any future agreement prove more durable? The security dilemma thus creates a self-fulfilling prophecy: preventive strikes undertaken to eliminate future threats confirm the target's perception that only nuclear weapons can provide security against attack.

Charles Glaser's (1997) refinement of security dilemma theory helps specify the conditions under which this spiral is most likely. When offensive and defensive capabilities are difficult to distinguish - as with uranium enrichment, which can produce both reactor fuel and weapons material - uncertainty about intentions is maximized. When the target regime faces multiple security threats and lacks reliable allies, its incentive to acquire independent deterrent capabilities is strongest. And when the attacking power has previously demonstrated willingness to use force preventively; the target's assessment of the probability of future attack, approaches certainty. Iran in 2024–2025 satisfied all these conditions, making the security dilemma particularly intense.

Prospect Theory and Risk Acceptance

While the security dilemma explains why preventive strikes increase the target's perceived need for nuclear weapons, prospect theory explains why targets become more willing to accept the risks of pursuing them. Developed by Daniel Kahneman and Amos Tversky (1979), prospect theory challenges the expected utility framework that dominates rational choice approaches to international relations. Rather than evaluating outcomes in absolute terms, decision-makers assess choices relative to a reference point; rather than being consistently risk-averse, they are risk-averse in the domain of gains but risk-seeking in the domain of losses.

The application to counter-proliferation is straightforward but profound. Before preventive strikes, a state with nuclear latency faces a choice between certain constraints - verification, inspections, limitations on enrichment - and the uncertain benefits of weapons capability. The reference point is the status quo of latent capability, and the decision to remain non-nuclear is made in the domain of gains. The state avoids the risks of sanctions, isolation, and military confrontation while preserving the option value of future weaponization if circumstances change.

Preventive strikes fundamentally alter this calculus. The reference point shifts: the state has now suffered losses of infrastructure, personnel, and international standing. The choice is no longer between the status quo and

weapons pursuit, but between accepting permanent vulnerability and gambling on rapid weaponization to deter future attacks. In the domain of losses, decision-makers become risk-seeking. The gamble of sprinting to nuclear weapons—previously unattractive because of its uncertainties—becomes preferable to the certain loss of security that inaction implies.

Jack Levy's (1997) application of prospect theory to international relations emphasizes that reference points are not objectively given but subjectively constructed through framing and interpretation. Iranian leaders in 2024–2025 did not simply react to physical destruction; they interpreted that destruction through narratives of national resistance and historical grievance that amplified the sense of loss. The strikes were framed not as limited military operations but as continuations of Western imperialism dating to the 1953 coup, the 1980s support for Iraq, and decades of economic warfare. This framing transformed tactical setbacks into existential threats, intensifying the risk-seeking behavior that prospect theory predicts.

The temporal dimension is crucial. Prospect theory suggests that decision-makers are more sensitive to immediate losses than to future gains. The destruction of facilities is immediate and visible; the benefits of restraint - avoided sanctions, potential integration into the global economy—are distant and uncertain.

Moreover, the experience of attack creates what psychologists call "availability bias": the vivid memory of destruction makes future attack seem more probable than statistical analysis would warrant. Iranian decision-makers, having experienced Israeli and American strikes, could not easily dismiss the possibility of repetition. The rational response to this updated probability assessment was to accelerate the very program that the strikes sought to eliminate.

Organizational Learning and Institutional Resilience

The third pillar of the theoretical framework addresses how nuclear programs adapt to external pressure over time. Organizations are not passive recipients of punishment; they learn, evolve, and develop resilience in response to challenges. James March's (1991) work on organizational learning distinguishes between exploitation of existing capabilities and exploration of new ones, while Scott Sagan's (1993) study of nuclear safety demonstrates how complex organizations develop cultures and routines that shape their response to external demands.

Nuclear programs facing preventive action undergo intensive organizational learning. The destruction of facilities teaches engineers to disperse and harden future installations. The assassination of scientists leads to enhanced security protocols and compartmentalization of

knowledge. The experience of cyberattack - Stuxnet in 2010 being the paradigmatic example - drives investment in air-gapped systems and manual overrides. Each counter-proliferation measure generates countermeasures that make subsequent efforts more difficult.

This learning occurs at multiple levels. Individual scientists and engineers develop technical solutions to specific problems: how to shield centrifuges from electromagnetic pulse, how to enrich uranium in smaller cascades that are harder to detect, how to manufacture components domestically to evade export controls. Organizational units develop new procedures: redundant reporting lines, deception operations, rapid relocation protocols. And the program as a whole develops strategic doctrines: never concentrating capability in single points of failure, maintaining multiple pathways to weapons material, preparing for "breakout" scenarios where latent capability is rapidly converted to weapons.

The Iranian program demonstrated this organizational learning with particular sophistication. After the Stuxnet attack, Iranian engineers developed indigenous control systems less vulnerable to external manipulation. After the assassination of scientists, the program decentralized its leadership and restricted information flows. After years of sanctions, Iran developed clandestine procurement networks and domestic manufacturing

capabilities that reduced dependence on foreign suppliers. By 2024, the program had evolved from a relatively centralized, declared effort into a dispersed, hardened, and adaptive system—precisely the evolution that preventive strikes were intended to prevent.

Organizational theory also illuminates the internal politics of proliferation decisions. Nuclear programs are not unitary actors but coalitions of organizations with distinct interests: the atomic energy establishment seeking budget and prestige, the military seeking operational capabilities, the foreign ministry seeking diplomatic leverage, the intelligence services seeking covert options. Preventive strikes alter the balance of power within this coalition. Organizations responsible for program protection and hardening gain influence; those advocating restraint or negotiation lose standing. The Revolutionary Guard Corps, which assumed greater control over the nuclear program after 2010, had organizational interests in continued confrontation that differed from those of civilian technocrats.

Jacques Hymans's (2006) work on the psychology of nuclear proliferation emphasizes the role of organizational culture in shaping how programs respond to pressure. Programs led by "oppositional nationalists" - leaders who combine intense national pride with profound distrust of the international order—are particularly likely to respond to external pressure with

defiance rather than accommodation. Iranian nuclear decision-making after 2024 was dominated by precisely such figures, whose identity and organizational interests were bound up with resistance to Western pressure. Preventive strikes, by confirming their worldview and marginalizing more moderate voices, strengthened the hand of those most committed to weapons acquisition.

Synthesis: The Mechanisms of the Proliferation Paradox

These three theoretical perspectives combine to explain the proliferation paradox: the tendency of preventive strikes to accelerate rather than prevent nuclear weapons acquisition. The security dilemma generates the motivation for proliferation by demonstrating that the target's security is incompatible with the attacker's interests. Prospect theory explains the increased willingness to accept risks in pursuit of proliferation once preventive strikes have occurred. And organizational learning ensures that subsequent proliferation efforts are more resilient and harder to reverse than the initial program that was destroyed.

The paradox is not inevitable. Under specific conditions—early stage programs, weak organizational capacity, regime vulnerability without nationalist legitimacy—preventive strikes may succeed without triggering these feedback mechanisms. The Syrian case

of 2007 satisfied these conditions: the program was nascent, dependent on external assistance, and not yet embedded in organizational structures or national identity. But these conditions are rare and difficult to identify in advance. As programs mature and organizational learning accumulates, the probability that preventive action will backfire increases substantially.

The Iranian case represents the limiting case of proliferation paradox dynamics. The program was mature, organizationally sophisticated, and deeply embedded in national identity. The security dilemma was intensified by decades of hostile relations with Israel and the United States and by the experience of the JCPOA's collapse. Prospect theory's predictions were reinforced by organizational culture that framed resistance as national virtue. And organizational learning had created a program specifically designed to survive the preventive action that ultimately occurred. Understanding why preventive strikes failed in this case requires attending to the interaction of structural, psychological, and institutional factors that the theoretical framework elaborates.

Methodology: Process Tracing and Comparative Analysis

The methodological approach of this study combines comparative historical analysis with detailed process

tracing of the Iranian case. This combination allows for both the identification of general patterns across cases and the examination of causal mechanisms within a single case that is crucial for theory development (Beach & Pedersen, 2019). The methodology is designed to address the challenges of studying proliferation decisions: the rarity of the phenomenon, the secrecy surrounding nuclear programs, and the difficulty of accessing decision-makers directly.

Comparative Case Selection

The study employs a structured, focused comparison of three cases: Iraq (1981), Syria (2007), and Iran (2004–2025). These cases were selected using the method of agreement and difference (Mill, 1843/1974): they share the outcome of being targets of preventive military action but vary in the outcome of proliferation success or failure. This variation allows for the identification of scope conditions under which the proliferation paradox operates.

The Iraqi case represents apparent preventive success that subsequent investigation revealed to be partial. The Israeli strike on Osirak destroyed the plutonium pathway but redirected Iraqi efforts toward uranium enrichment (Reiter, 2005). The case is useful for examining how organizational learning and redirection can occur even when strikes achieve their immediate technical

objectives. Data for this case draws on post-1991 UN inspections (Kay, 1995), Iraqi government documents captured after 2003, and retrospective interviews with participants.

The Syrian case represents genuine preventive success by narrow technical metrics: the reactor was destroyed and not rebuilt. But the case is exceptional in ways that limit generalizability: the program was in earliest stages, dependent on North Korean assistance, and the Assad regime faced internal challenges that made retaliation and rebuilding costly (Spector & Cohen, 2008). The case is useful for identifying the scope conditions under which preventive strikes succeed without triggering proliferation paradox dynamics. Data draws on intelligence assessments, International Atomic Energy Agency reports, and journalistic investigations (Bergman, 2018).

The Iranian case is the primary focus of process tracing. It represents the most extensive counter-proliferation effort in history, incorporating sanctions, sabotage, assassination, cyberattack, and ultimately direct military strikes. The case allows for examination of how different forms of pressure interact and how organizational learning accumulates over time. Data draws on IAEA reports, Iranian government statements, procurement records, satellite imagery, and—crucially—the

observable behavior of the program in response to specific events.

Process Tracing Methods

Process tracing is a method for examining causal mechanisms within cases, identifying the specific steps through which an independent variable influences a dependent variable (Beach & Pedersen, 2019). Within the Iranian case, this study traces three distinct causal processes: the security dilemma mechanism (how strikes affected threat perception), the prospect theory mechanism (how strikes altered risk calculus), and the organizational learning mechanism (how strikes prompted adaptation).

Data for process tracing comes from multiple sources. Official documents—including IAEA reports, UN Security Council resolutions, Iranian government statements, and Israeli and U.S. government communications—provide the structural context of decision-making. These documents are supplemented by journalistic accounts, academic studies, and think tank analyses that provide detail on specific events and decisions. Where possible, the study draws on memoirs and retrospective accounts by participants, though these must be treated with appropriate skepticism regarding self-justification and selective memory.

The study employs "hoop tests" and "smoking gun tests" to evaluate the presence of hypothesized mechanisms (Van Evera, 1997). Hoop tests establish necessary conditions: if the security dilemma mechanism is operating, we should observe Iranian leaders interpreting strikes as demonstrating hostile intent rather than limited objectives. Smoking gun tests establish sufficient conditions: if prospect theory is operating, we should observe risk-seeking behavior specifically in response to losses, not merely general aggressiveness.

Temporal sequencing is crucial for causal inference. The study examines whether changes in Iranian nuclear policy followed specific counter-proliferation measures with appropriate time lags, and whether alternative explanations—such as unrelated technological developments or internal political changes—can be ruled out. The 2018 U.S. withdrawal from the JCPOA and the 2024–2025 strikes provide natural experiments: abrupt changes in external pressure that allow for observation of Iranian responses.

Addressing Data Limitations

The study of nuclear proliferation faces inherent data limitations. Programs are secretive, decision-makers are inaccessible, and crucial documents may remain classified for decades. This study addresses these limitations through several strategies.

First, it relies heavily on observable behavior—investment patterns, procurement activities, facility construction - as indicators of intentions and capabilities. While intentions are unobservable, they are revealed through costly actions that are difficult to fake (Fearon, 1994). Iran's post-2025 expansion of enrichment capacity, its withdrawal from the Additional Protocol, and its dispersal of centrifuge components all constitute costly signals of commitment to nuclear advancement.

Second, the study triangulates across multiple data sources. When IAEA reports, satellite imagery, and Iranian government statements converge on a particular description of events, confidence in that description increases. When sources conflict, the study examines the incentives and capabilities of different actors to provide accurate information, and where possible identifies independent evidence to adjudicate disputes.

Third, the study acknowledges uncertainty where it exists. Rather than claiming definitive knowledge of Iranian decision-making processes, it identifies plausible mechanisms consistent with available evidence and evaluates alternative explanations. The goal is not certainty but reasonable inference based on the best available data.

Ethical Considerations

Research on contemporary nuclear programs raises ethical considerations regarding the potential misuse of findings. This study is designed to contribute to scholarly understanding and policy improvement, not to assist proliferation or attack planning. The information used is drawn from open sources and previously published analyses; no classified information is revealed. The theoretical framework suggests that preventive strikes are often counterproductive, a finding that if accepted would reduce rather than increase the likelihood of military action.

Case Analysis: The Iranian Program and the Failure of Kinetic Counter-Proliferation

The Iranian nuclear program has been the subject of counter-proliferation efforts for two decades, providing an unparalleled opportunity to observe how different forms of pressure interact and how organizational learning accumulates over time. This case analysis traces the program's evolution from the JCPOA's collapse through the 2024–2025 strikes, examining how each phase of external pressure generated the feedback mechanisms that the theoretical framework predicts.

The JCPOA and Its Collapse: Reference Point Shifts

The Joint Comprehensive Plan of Action of 2015 represented a potential settlement of the Iranian nuclear issue. Iran accepted comprehensive constraints:

reduction of centrifuges from 19,000 to 6,104, limitation of enrichment to 3.67% for 15 years, modification of the Arak reactor to prevent plutonium production, and implementation of the Additional Protocol providing enhanced IAEA access (Mousavian&Mousavian, 2018). In exchange, Iran received sanctions relief and the prospect of reintegration into the global economy.

From a prospect theory perspective, the JCPOA established a reference point of constrained capability with economic benefits. Iranian decision-makers evaluated choices relative to this status quo: remaining in compliance provided certain economic gains, while cheating or withdrawal risked sanctions and isolation. The agreement's verification provisions increased the probability of detection, raising the expected costs of defection. As long as the economic benefits materialized, the JCPOA created conditions for Iranian restraint.

The U.S. withdrawal in May 2018 fundamentally altered this calculus. President Trump's decision, taken despite IAEA confirmation of Iranian compliance, demonstrated that the United States would not be bound by agreements with Iran regardless of Iranian behavior. The reimposition of sanctions and the "maximum pressure" campaign shifted Iranian decision-makers into the domain of losses. The reference point of constrained capability with economic benefits was no longer attainable; the choice was between accepting permanent

economic strangulation or taking risks to change the strategic situation.

Iranian responses to maximum pressure illustrate prospect theory's predictions. Rather than capitulating to demands for more comprehensive constraints, Iran progressively reduced its JCPOA compliance beginning in May 2019. Each step - exceeding enrichment limits, resuming activities at Fordow, reducing IAEA access—was calibrated to increase pressure on European parties to the agreement while avoiding full withdrawal. This pattern of incremental escalation, testing responses at each stage, is characteristic of risk-seeking behavior in the domain of losses: accepting gambles that would have been rejected when the status quo was acceptable.

The organizational dimension is equally important. The JCPOA had created winners and losers within the Iranian system: technocrats and business interests who benefited from sanctions relief, versus hardliners in the Revolutionary Guard who viewed the agreement as capitulation. Maximum pressure strengthened the hand of the latter group, demonstrating that engagement with the West produced only betrayal. By 2020, the Guard had assumed effective control over the nuclear program, marginalizing the civilian Atomic Energy Organization and ensuring that military perspectives dominated decision-making.

Sabotage and Assassination: Organizational Learning

The period from 2018 to 2024 saw an intensification of covert Israeli operations against the Iranian program: sabotage of centrifuge production facilities, attacks on nuclear sites, and the assassination of senior scientists including Mohsen Fakhrizadeh in November 2020 (Bergman, 2018). These operations were tactically successful in causing damage and delay, but their strategic effects illustrate the organizational learning mechanism.

Each operation prompted specific adaptations. The Natanz explosion of July 2020, attributed to Israeli sabotage, destroyed an advanced centrifuge assembly facility. Iranian response included dispersing assembly operations to multiple locations, hardening facilities against similar attacks, and accelerating domestic manufacturing to replace destroyed equipment. The assassination of Fakhrizadeh led to enhanced security protocols, compartmentalization of program knowledge, and elevation of younger scientists who had trained under his mentorship.

More significantly, these operations transformed organizational culture. The nuclear program had always possessed security consciousness, but the experience of repeated attack created what organizational theorists call

"threat rigidity"—a narrowing of decision-making and increased commitment to existing goals (Staw et al., 1981). Moderate voices advocating negotiation or restraint were increasingly marginalized as the program became defined by resistance to external pressure. The scientists and engineers who remained were those most committed to program continuation regardless of cost.

The procurement networks that supplied the program demonstrated particularly sophisticated learning. Early reliance on the A.Q. Khan Network and established suppliers had created vulnerabilities that sanctions and interdiction exploited. By 2020, Iran had developed alternative procurement channels through front companies in third countries, indigenous manufacturing capabilities for key components, and dual-use technologies that were harder to control. Each successful interdiction taught procurement officers what to avoid; each successful acquisition demonstrated that controls could be evaded with sufficient effort and resources.

The 2024–2025 Strikes: Paradoxical Effects

The direct military strikes of October 2024 through June 2025 represented the culmination of kinetic counter-proliferation and their most extensive application. American B-2 bombers targeted hardened underground facilities at Fordow and Natanz with massive ordnance penetrators. Israeli fighter aircraft, operating through

corridors prepared by special operations forces, struck declared and suspected nuclear sites across Iran. Israeli officials announced the destruction of over 70% of declared nuclear infrastructure.

The immediate effects were substantial. Centrifuge cascades were destroyed, enrichment activities halted, and IAEA monitoring equipment disabled. The technical setback was real and significant: rebuilding the destroyed capacity would require months or years and substantial investment. By the narrow metric of facility destruction, the strikes succeeded.

But the political and organizational effects ran in the opposite direction. Within days of the initial strikes, Iran formally withdrew from the Nuclear Non-Proliferation Treaty, eliminating the legal framework that had provided at least nominal constraints. The IAEA inspectors who had provided independent verification of Iranian activities were expelled, ending the transparency that the international community had relied upon to detect proliferation. And Iranian leaders, across the political spectrum, publicly committed to rebuilding the program with greater determination than before.

The security dilemma mechanism operated with particular clarity. Iranian officials framed the strikes not as limited operations against specific facilities but as acts of aggression demonstrating that Iran's security could

never be assured through agreement with Western powers. Supreme Leader Ayatollah Khamenei's statements emphasized that the attacks confirmed the wisdom of his long-standing distrust of the United States, validating the narrative that only independent capability could provide security (Kamrava, 2012). This framing transformed tactical setbacks into evidence of the necessity of nuclear weapons.

Prospect theory's predictions were equally evident. Iranian decision-making after the strikes exhibited classic risk-seeking behavior in the domain of losses. Rather than accepting the destruction of facilities as reason to abandon the program, Iran accelerated efforts to achieve weapons capability before further strikes could occur. Uranium enrichment, previously capped at 60% purity, was pushed toward weapons-grade levels. The gamble of rapid weaponization—previously considered too risky because of the probability of military response—became attractive because the alternative was perceived as permanent vulnerability to attack.

Organizational learning ensured that the rebuilt program would differ fundamentally from what was destroyed. Dispersal, which had already begun in response to sabotage, became comprehensive: centrifuge components were distributed across dozens of locations, many never declared to international inspectors.

Hardening reached new levels, with facilities constructed deep underground in geologies resistant to conventional attack. And the program's leadership, purged of moderates through years of assassination and marginalization, was united in commitment to rapid weapons acquisition.

The verification collapse was perhaps the most significant long-term effect. The IAEA's presence in Iran, however imperfect, had provided independent monitoring that constrained Iranian options and provided early warning of proliferation. The strikes eliminated this monitoring, creating an information vacuum in which Iranian activities could proceed without external observation. Future counter-proliferation efforts would face the dual challenge of targeting dispersed, hardened facilities while lacking the intelligence necessary to locate them.

Comparative Assessment

Comparison with the Iraqi and Syrian cases illuminates why the Iranian strikes produced paradoxical effects while earlier strikes appeared more successful. The Iraqi program in 1981 was in an earlier stage of development, less organizationally sophisticated, and Saddam Hussein's response - redirecting toward enrichment rather than abandoning proliferation - illustrates partial paradox dynamics that were not immediately visible.

The Syrian program in 2007 was truly nascent, lacking the organizational embedding and national significance that would have generated sustained rebuilding efforts.

Iran in 2024–2025 represented the maturation of all the factors that generate proliferation paradox. The program was organizationally sophisticated, with two decades of experience in evading pressure. It was embedded in national identity, framed as achievement against Western technological denial. And it was led by decision-makers operating in the domain of losses, for whom risk-seeking behavior was psychologically compelling. Preventive strikes against such a program were not merely unlikely to succeed; they were structurally designed to produce the opposite of their intended effect.

Policy Implications: Beyond Kinetic Counter-Proliferation

The theoretical framework and empirical findings of this study carry significant implications for policy. If preventive strikes often generate self-defeating feedback loops, then alternative approaches to counter-proliferation must be developed and prioritized. This section outlines the elements of such an approach, recognizing that no strategy guarantees success but that some strategies are more likely to fail than others.

The Verification Imperative

The most significant long-term damage of the 2024–2025 strikes may prove to be the destruction of verification mechanisms. The IAEA's presence in Iran, however imperfect and contested, provided independent monitoring that constrained Iranian options and provided warning of proliferation. Its elimination creates an information vacuum in which Iranian nuclear activities can proceed without external observation.

Future policy must prioritize the restoration of verification, even at the cost of accepting limited Iranian nuclear activity. The JCPOA's constraints, while valuable, were secondary to its verification provisions: the ability to detect cheating creates the foundation for any effective response. A policy that destroys facilities but eliminates verification trades temporary technical setback for permanent uncertainty—a poor exchange by any strategic calculus.

Restoring verification will require addressing the legitimacy concerns that Iranian leaders have articulated. The experience of the JCPOA's collapse demonstrated that agreements with the United States may not survive changes in administration, creating incentives for Iran to maximize capability during periods of restraint. Addressing this requires institutionalized commitments - congressional ratification of agreements, security assurances from multiple powers, and linkage to broader regional security architectures—that reduce the

uncertainty that prospect theory identifies as driving risk-seeking behavior.

Security Assurances and the Security Dilemma

The security dilemma framework suggests that Iranian nuclear ambition is driven partly by genuine security concerns that preventive strikes confirm rather than alleviate. Any effective counter-proliferation strategy must address these concerns through credible security assurances, reducing the perceived necessity of independent nuclear capability.

Such assurances face substantial obstacles. Iranian leaders distrust American commitments for historically grounded reasons; Israeli security concerns create opposition to any accommodation with Tehran; and regional rivalries - particularly with Saudi Arabia—make bilateral security guarantees difficult to construct. But the alternative—continued confrontation that drives Iran toward nuclear weapons—appears worse.

Regional security architecture offers a potential pathway. The Abraham Accords demonstrated that Arab states could normalize relations with Israel despite the Palestinian issue; a broader framework that included Iran, providing recognition and security guarantees in exchange for verified nuclear constraints, could address the security dilemma dynamics that drive proliferation. China's mediation of the Iran-Saudi rapprochement in

2023 suggests that external powers can facilitate such arrangements when traditional security guarantors are unable or unwilling to do so.

Economic Incentives and Reference Points

Prospect theory's emphasis on reference points suggests that Iranian decision-making is shaped by the perception of gains and losses relative to expectations. The JCPOA's collapse was particularly damaging because it shifted Iranian leaders from the domain of gains to the domain of losses, triggering risk-seeking behavior. Future agreements must be structured to avoid similar shifts.

This requires not merely sanctions relief but positive economic integration that creates constituencies for compliance within Iran. The technocrats and business interests who supported the JCPOA were marginalized by maximum pressure; their re-empowerment requires demonstrable benefits from restraint. The European Union's efforts to maintain economic channels despite U.S. sanctions, however imperfect, represented recognition of this imperative.

More broadly, the international community must consider how its actions shape Iranian reference points. Threats of military action, while intended to deter proliferation, may have the opposite effect by confirming worst-case assumptions and shifting decision-makers

into the domain of losses. Coercive diplomacy is most effective when the target perceives that compliance can restore a valued status quo; when compliance is perceived as impossible regardless of behavior, coercion generates defiance rather than accommodation.

Organizational Engagement and Learning

The organizational learning mechanism suggests that Iranian nuclear capabilities will continue to evolve in response to external pressure, becoming more dispersed, hardened, and secretive. Countering this evolution requires engagement with the organizations responsible for the program, creating alternative paths for professional advancement and organizational prestige.

Scientific engagement programs, which brought Iranian nuclear scientists into international research collaborations, represented one such approach. These programs were criticized for providing cover for proliferation, but they also created relationships and professional interests that could be leveraged for restraint. The assassination of Iranian scientists, whatever its immediate tactical effects, eliminated individuals with international connections and replaced them with figures whose careers had been shaped entirely within the secretive, confrontational environment of the program.

Future policy should consider how to create organizational incentives for transparency. The IAEA's complementary access provisions, which allow inspection of undeclared sites, depend on Iranian cooperation that is shaped by organizational culture. Building professional relationships between Iranian nuclear organizations and their international counterparts, however difficult in a confrontational environment, may prove more effective than isolation in shaping that culture over time.

The Limits of Unilateral Action

The 2024–2025 strikes were conducted primarily by Israel and the United States, with limited international participation and substantial international criticism. This unilateralism carried costs: legitimacy deficits that limited the ability to build coalitions for subsequent action, normative erosion that weakened the non-proliferation regime, and demonstration effects that may motivate other states to acquire nuclear capabilities.

Effective counter-proliferation requires multilateral legitimacy. The JCPOA's strength derived partly from its multilateral character: negotiations involving the P5+1 created international buy-in that the United States alone could not generate. The Trump administration's unilateral withdrawal demonstrated the vulnerability of this approach but also the costs of abandoning it.

Rebuilding multilateral consensus on Iran will be difficult but necessary. It requires acknowledging the legitimate security concerns of regional actors—Israel, Saudi Arabia, the Gulf states—while recognizing that their preferred strategies of maximum pressure and preventive strikes have failed. A sustainable approach must integrate these actors into a broader security framework rather than simply deferring to their preferences.

Accepting Uncertainty

The most difficult implication of this study is that counter-proliferation involves irreducible uncertainty. Preventive strikes offer the illusion of control: the visible destruction of facilities creates the appearance of decisive action. But the feedback mechanisms identified in this framework suggest that such control is illusory, that the consequences of action are less predictable than they appear, and that the long-term effects of strikes may be the opposite of their immediate results.

Accepting uncertainty requires strategic patience and tolerance for ambiguity. A policy that prioritizes verification over destruction that accepts limited Iranian nuclear activity in exchange for transparency, that builds economic and security relationships over time, cannot promise quick results. It requires sustaining engagement through periods of Iranian defiance, maintaining

coherence across changes in administration, and accepting that success may be measured in non-events—proliferation that does not occur—rather than visible victories.

This is unsatisfying for policymakers seeking decisive solutions. But the record of the past two decades suggests that decisive solutions to the Iranian nuclear issue are illusory. The choice is not between success and failure but between strategies that are more or less likely to produce the outcomes that all parties claim to seek: a Middle East without additional nuclear weapons states and without the catastrophic war that nuclear proliferation threatens to enable.

Conclusion: The Future of Nuclear Order

The preventive strikes of 2024–2025 against Iranian nuclear facilities will be studied for decades as a test of kinetic counter-proliferation. Their immediate technical success—destruction of facilities, degradation of capability, demonstration of military precision—was undeniable. Their strategic failure - acceleration of Iranian weapons pursuit, collapse of verification, consolidation of hardline control - was equally clear. The gap between these outcomes defines the proliferation paradox that this study has elaborated.

The theoretical framework developed here—integrating security dilemma, prospect theory, and organizational

learning—explains why this gap is not accidental but structural. Preventive strikes communicate hostility that confirms the target's perception of existential threat. They shift decision-makers into the domain of losses where risk-seeking behavior becomes attractive. And they prompt organizational adaptations that make subsequent proliferation more resilient. These mechanisms operate regardless of the specific intentions of attacking or target states; they are products of the strategic situation rather than individual choices.

This is not an argument for passivity in the face of proliferation threats. Nuclear weapons in the hands of adversarial regimes pose genuine dangers that states have legitimate interests in preventing. But the record of the Iranian case suggests that kinetic counter-proliferation is not merely insufficient but actively counterproductive under conditions that are increasingly common: mature programs, organizational learning, and nationalist legitimacy. Alternative approaches—verification, security assurances, economic integration, organizational engagement - may offer better prospects for achieving the underlying goal of preventing nuclear war.

The broader implications extend beyond the Iranian case to the future of nuclear order itself. The Nuclear Non-Proliferation Treaty, concluded in 1968, has proven more durable than its critics predicted, limiting the

spread of nuclear weapons despite widespread expectations of proliferation cascades. But the treaty's durability rests on a delicate balance of incentives: the promise of peaceful nuclear technology, the security assurances of nuclear weapon states, and the threat of isolation for violators. The preventive strikes of 2024–2025 have damaged this balance by demonstrating that even states under comprehensive safeguards can be attacked, that the distinction between peaceful and military programs can be erased by political fiat, and that the nuclear weapon states are willing to use force to maintain their oligopoly.

These demonstrations have effects beyond Iran. States considering nuclear options—Saudi Arabia, Turkey, South Korea, others—observe the fate of Iranian restraint and draw appropriate conclusions. If accepting constraints and verification provides no protection against attack, then the incentive is to acquire weapons capability as rapidly as possible, before preventive action can occur. The paradox of preventive strikes is that they may prevent the specific program they target while motivating the broader proliferation they seek to prevent.

The study of international relations has always grappled with the tension between immediate security and long-term order. Preventive strikes offer the former at the expense of the latter; they solve today's problem by creating tomorrow's. The theoretical framework and

empirical analysis presented here suggest that this trade-off is not merely unfortunate but predictable, built into the structure of strategic interaction between attackers and targets. Recognizing this predictability is the first step toward developing strategies that can achieve both security and order, that can prevent nuclear war without generating the conditions for future conflicts.

The Iranian nuclear program will continue to evolve, shaped by decisions in Tehran, Jerusalem, Washington, and capitals around the world. The specific outcomes are uncertain, contingent on choices not yet made. But the mechanisms identified in this study—the security dilemma's spiral logic, prospect theory's risk calculus, organizational learning's adaptive power—will continue to operate, constraining the possible and making some futures more likely than others. Understanding these mechanisms does not guarantee wise policy, but it makes wisdom possible. In a world where nuclear weapons remain the ultimate instruments of destruction, that possibility is worth the effort of sustained theoretical and empirical inquiry.

The strikes of 2024–2025 have passed into history. Their consequences will shape the Middle East and the international order for generations. Whether those consequences include Iranian nuclear weapons, regional nuclear proliferation, or catastrophic war depends on whether policymakers learn the lessons that this study

has attempted to articulate. The record of the past suggests skepticism about such learning; the stakes of the future demand it nonetheless.

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