ADDRESSING NUCLEAR TERRORISM: AN INTERDISCIPLINARY APPROACH

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Presumably, the dream of nuclear peace might be disrupted not by states, rather by non-state actors. The danger of nuclear terrorism is reverberating nowadays due to the chances of a nuclear weapon falling into terrorist hands or a possible terrorist sabotage on a nuclear facility. On 15th August 2012, Leon Panetta, U.S. Defence Secretary, warned of the increasing risk of nuclear terror, mentioning that some of Pakistan's nuclear weapons might be handed over to terrorists if Islamabad failed to control terrorism.[1] After five days, reportedly, the International Atomic Energy Agency (IAEA) attempts to seek more financial support to stride, to prevent and mitigate chances of nuclear terrorism in the world.[2]

While many argue the low possibility of nuclear terror in abundant literature, the fear of nuclear terror is not lessening. This is probably owing to a number of reasons: first, various kinds of massive terror attacks have seen unleashed since 9/11, giving a impression that any kind of attack may be possible in the long-run; second, the prevention of nuclear terror by a state is not viewed to be fully dependable as terrorist groups always explore all possible approaches to attain their desires no matter how much damage they do to have; third,

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1. "Pakistan's Nuclear Weapons May Fall into Hands of Terrorist: Leon Panetta", *The Economic Times*, August 15, 2012 available at http://articles.economictimes.indiatimes.com/2012-08-15/news/33216731_1_nuclear-weapons-nuclear-power-terrorism accessed on 15 Sep 12
2. "GSN: IAEA Security Official Seeks More Money to Prevent Nuclear Terrorism", *Newsroom America*, August 20, 2012 available at http://www.newsroomamerica.com/story/271364.html accessed oon 21 Sep 12.

international cooperation is under constant criticism due to the way practical security improvements can be measured as being at a snail's pace.

In the discourse about nuclear terror, a number of steps need to be arranged properly: in terms of amplifying strategic calculations, setting socio-political agendas for use, acquiring material and tool-kits, exercising technology, maintaining tight and secret channels, adequate financial arrangements, preparing a delivery system, and so on. Therefore, as a multi-dimensional subject, nuclear terrorism invites various perspectives and academic analyses. Terrorism study and nuclear proliferation research cover nuclear terrorism in their main domains. Each of them suggests different assumptions and logics providing key components for the risk-policing of nuclear terror and exploring various implications. These two study areas further interact with other areas, such as criminology, economics and intelligence, in discovering the missing points of nuclear terrorism. Noticeably, it is important to produce the accepted array of knowledge by a combined understanding of the subject for the groundwork of creating an effective policy against nuclear terror. This paper attempts to analyse how the single phenomenon of nuclear terrorism has far reaching implications for multiple dimensions and of an interdisciplinary approach is appropriate to enquire to decode its various dimensions.

AN OVERVIEW

Largely, the definition, method, and the potential types of nuclear terror are elaborated in a consensual manner. Ferguson and Potter encompasses various contours of nuclear terrorism as[3]:

- *The theft, or illicit purchase, of an intact nuclear weapon from a national arsenal and its detonation*
- *The theft or illicit purchase of fissile material to make and detonate an improvised nuclear device (IND)*
- *Attacks on, or the sabotage of, either civil or military nuclear facilities, such as power reactors or spent fuel ponds to release radioactivity*

3. Wyn Q. Bowen, Matthew Cottee and Christopher Hobbs (2012), "Multilateral Cooperation and the Prevention of Nuclear Terrorism: Pragmatism over Idealism", *International affairs* 88(2), pp. 354-358.

- *The theft, or illicit purchase, of non-nuclear radioactive materials to make and detonate a radiological dispersion device (RDD) or to make and deploy a radiation emission device (RED)*

Nuclear Terror Antecedents

In the 1960s, the concept of terrorism was almost denied as Robert McNamara, the former Secretary of Defense of the U.S., declined to use the terminology, 'terrorist'.[4] During the 1970s and 1980s, less attention was paid to defining the actors; the possibility of nuclear terrorism was perceived as a non-national risk; a part of the state-level proliferation problem.[5] The probable actors were not exactly mentioned as terrorist groups during this time, rather they were illustrated to a large extent by all groups: "insurgents, guerrillas, extremists or dissident groups".[6] In 1976, the Central Intelligence Agency (CIA) attempted to designate the key characteristics of transnational terrorist group in terms of their number, networking, violent actions, intensity and the nature[7] However, the rough conceptualisation of the actors was yet to be clear and the possible scenarios were vaguely drawn when these actors could only acquire nuclear capability as a gift in exchange for bribery from states plagued by corruption.[8] Most of the probable scenarios pictured by the Pentagon were linked to the Cold War such as; the U.S was exposed to vulnerability such as when the Soviets or Chinese would provide tactical nuclear weapon (TNWs) to the Vietcong.[9]

In the 1990s, with concerns over the disintegration of the Soviet Union, the probability of nuclear terrorism was triggered by the loose-nuke issue. In the observation of scattered non-state actors, newly independent republics in the Black Sea region, Middle East and Eastern Europe were inferred to be highly volatile areas for nuclear smuggling chains coping

4. Micha Zenko (2006), "Intelligence Estimates of Nuclear Terrorism", *The ANNALS of the American Academy of Political and Social Science*, 607, p.93.
5. Thomas C. Schelling (1982), "Thinking about Nuclear Terrorism", *International Security* 6(4), p. 62.
6. Micha Zenko, n.4, p.93.
7. David L. Milbank (1976), "International and Transnational Terrorism: Diagnosis and Prognosis", *Central Intelligence Agency Research Study*, April 1976, p.1.
8. n. 5.
9. Micha Zenko, n.4, p.93.

The increasing quantity of nuclear material, for civilian and military use, has also been a major focus in predicting the risk of nuclear terror

with terrorists, rebels, and criminals.[10] U.S. intelligence revealed a nuclear smuggling root in 1993; Al Qaida attempted to acquire weapon-grade nuclear materials from former Soviet republics and through Sudanese military officers.[11] During this time, while pessimism prevailed on nuclear risks leaking from the former USSR, it was believed that the risk of nuclear terrorism was less incurred by leakage from state-terrorist trading. Rather, there was a widespread understanding that the risk existed at the group or personal level as well, as shown from the A. Q. Khan network, with criminal involvement that had previously been overlooked.[12]

Since 2001, after the striking incident of 9/11, Al Qaida and the Taliban have been placed at the forefront of discussions about nuclear terrorism with global terrorists and criminal networks. The WINPAC report, produced in 2001, stated that Osama bin Laden's access to nuclear scientists had involved Pakistan's nuclear program prior to 9/11.[13] The surprising scale of terrorist strategies using other Weapons of Mass Destruction (WMDs) and the abruptly increasing number of terrorist groups are largely contained in calculating the risk of nuclear terrorism until now.

Simultaneously, the increasing quantity of nuclear material, for civilian and military use, has also been a major focus in predicting the risk of nuclear terror. While only nine states have achieved nuclear weapons capability, there has been more focus on the nuclear materials and civilian use of nuclear facilities for nuclear theft and sabotage. Including the radioactive material to produce dirty bombs, the calculation of the risk is obsessively increased further as it is seen that the theft of nuclear material or sabotage of nuclear facilities would provide more chances to terrorist groups.

Overall, with the observation of historic notes, optimists tend to

10. Maj. Gen. Bruce Lawlor (ret.) (2011), "The Black Sea: Center of the Nuclear Black Market", *Bulletin of the Atomic Scientist*, 67(6). pp.73-80.
11. Micha Zenko, n.4, p.93.
12. Stephen Sloan, (2002), "Meeting the Terrorist Threat: The localization of Counter Terrorism Intelligence", *Police Practice and Research*, 3(4), pp. 337-338.
13. WINPAC report (2001), November 23, 2001. WMD commission pp. 271, 277.

conclude that nuclear terror is nearly impossible.[14] Extensive nuclear literature supporting this opinion assumes the low chance of nuclear terrorism in terms of technological and material accessibility aspects despite terrorists' interest. However, the conventionalists warn that the threat of nuclear terrorism is not minuscule; it is matter of "when, not if".[15]

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CLAIMS FOR SOME CLARIFICATIONS

The understanding of the risk of nuclear terror is fraught with altercations about different methodologies; qualitative or quantitative analysis. It needs to be corrected in some portions, when many have quoted the risks of nuclear terrorism from one to another blindly.

In the middle of the discussion of the risks of nuclear terrorism, some offer to clarify implausible arguments spread across much literature. Often, the perils of fissile material proliferation are predominantly discussed within the risks of nuclear terrorism, related to the amount of fissile materials stored over thirty-two countries.[16] Placing the multiple uses of these materials, like highly enriched uranium (HEU) and plutonium (Pu), scholars frequently convey the confusion in their writing that more stockpiles bring more risks. Until the late 1990s, this view was blindly accepted in much writing with the heightened concern over the lax security culture and increasing criminal involvement around the world. However, as statistical analysis begun to be used in studying the lineage of nuclear proliferation and terrorism, it started to correct some overrated speculations. Recently, much effort in

14. Nathan Busch (2010), "Risk of Nuclear Terror: Vulnerabilities to Theft and Sabotage at Nuclear Weapons Facilities", Contemporary Security Policy, 23(3), p. 20. Morten Bremer Maerli, Annette Schaper, and Frank Barnaby (2003), "The Characteristics of Nuclear Terrorist Weapons", American Behavioral Scientists, 46(6), p. 728., Todd Masse (2010), "Nuclear Terrorism Redux: Conventionalists, Skeptics, and the Margin of Safety", *Orbis* 54(2), pp.302-319.
15. Todd Masse (2010), "Nuclear Terrorism Redux: Conventionalists, Skeptics, and the Margin of Safety", *Orbis* 54(2), p.302.
16. NTI Nuclear Materials Security Index, January 2012, The Nuclear Threat initiative.

The probability of operating a nuclear attack or theft in some countries is higher than in other countries

statistical analysis emphasises that one must not exaggerate the risk of leaking weapon-usable nuclear materials by saying that large quantities of nuclear stockpiles result in a high probability of nuclear theft. Indeed, it does not matter what quantities are stored, whether enough to make ten bombs or a hundred bombs, but it matters where and how much it will cost for terrorist groups to acquire it. Ostensibly, it is said, "[the] total quantity of nuclear material is not a good indicator of theft risks".[17]

Another falsification can be clarified by using both methodologies to link the risk of nuclear terror and state-sponsored terrorism. Specifically, it is a main issue whether the correlation between the risk of nuclear terror and nuclear states outside the Nuclear Non-proliferation Treaty (NPT) regime is positive or not. Broadly, Iran, North Korea and Pakistan are frequently mentioned with the same level of concern drawing illicit nuclear activity to terrorist groups in the future. Iran, positioned in controversy, is frequently referred to as one of the most dangerous states garnered to its nuclear aspiration and links with terrorist groups. North Korea is also mentioned as a rogue state by historical records of nuclear proliferation and a symbolic implication of loopholes in the nuclear non-proliferation regime. Pakistan, currently one of the highlighted states, mostly because of concerns over the tracing of nuclear proliferation and state-sponsored terrorism, causes worries that it is an unpredictable nuclear holder in the nuclear terrorism scenario.[18] Overall, it is true that all these states are in a stalemate in international politics, so that they may seek non-state actors for third party cooperation to overcome hardships. However, it is invalid to see these states at the same level of diplomatic and military strategies needed to deal with terrorists.

According to Daniel Byman (2007), the probability of operating a nuclear

17. Matthew Bunn (2006), "A Mathematical Model of the Risk of Nuclear Terrorism," *The ANNALS of the American Academy of Political and Social Science* 607, September 2006, p.113.
18. The Economist, 23 August 2012.

attack or theft in some countries is higher than in other countries.[19] Nuclear weapon states can be categorised into three level; high, medium and low in their classification of security capacity, corruption levels and terrorist penetration risk. All those factors combined provide an analysis of the supply-side of leakage characteristics of nuclear weapon states. While two states like Iran and North Korea stay at a medium-level risk over invoking the risk of nuclear terror, Pakistan is shown to be an extremely unsafe state for nuclear leakage in combination with high levels of corruption and terrorist penetration risk.

Table 1. Leakage Characteristics of Nuclear Weapons State

Iran[20]	Medium	Medium	Medium	Medium
DPRK	High	Medium	Low	Medium
Pakistan	Medium	High	High	High

Source: partially extracted from Daniel Byman (2007), "Do Counterproliferation and Counterterrorism Go Together?", *Political Science Quarterly* 122(1), p.36

Another careful test is needed to examine the risk of nuclear terrorism in measuring capability among large numbers of terrorist groups. Currently, fifty one Foreign Terrorist Organisations (FTOs) are registered in the bureau of counterterrorism, within the U.S. Department of State.[21] Forty-eight international terrorist organisations are enlisted under the Terrorism Act 2000 in the UK.[22] Australia has elicited seventeen terrorist groups to accomplish effective counter-terrorism measurements with a singular

19. Daniel Byman (2007), "Do Counterproliferation and Counterterrorism Go Together?", *Political Science Quarterly 122*(1), pp.35-37.
20. Iran, not a nuclear weapon state, is included as many pay attention to Iran's current nuclear programme in regard to a nuclear and terrorism nexus. Daniel Byman (2007), "Do Counterproliferation and Counterterrorism Go Together?", *Political Science Quarterly* 122(1), p. 36.
21. "Foreign Terrorist Organizations", Bureau of Counterterrorism, U.S. Department of State, January 27, 2012. available at http://www.state.gov/j/ct/rls/other/des/123085.htmaccessed on 12 Sep 12.
22. "Proscribed Terrorist Organisations", Home Office, United Kingdom, pp. 1-7, available at http://www.homeoffice.gov.uk/publications/counter-terrorism/proscribed-terror-groups/proscribed-groups?view=Binary accessed o 10 Oct 12.

standard.[23] While many agree on the risk of nuclear terror, especially by Al Qaida, there is lack of analysis based on cross-tabulation research. Perhaps, it is owing to the lack of accessing and sharing information and the different threat perceptions that states face. As is also seen in the report provided by United Nations Monitoring Group on Al-Qaida and Taliban (1267 Sanctions Committee), terrorist capability for nuclear terrorism tends to be explained in narrative, as it is also in intelligence estimation.[24] Therefore, academic research generally borrowed from official reports tends to carelessly exaggerate the risk, such as quoting a leader's comment on terrorist strategies on WMDs. This hinders the cost-effectiveness approach for the next step in the prevention of nuclear terrorism.

According to those who advocate a cost-effectiveness approach in establishing the prevention of nuclear terrorism, the investment in security measures against nuclear terrorism should be distributed when and where necessary. Seeing that each government faces the difficulty of budget allocation for the prevention of the terrorism with WMDs, security measures need to seek efficiency, as it impossible to extend the measures in an unlimited way. For this reason, the interdisciplinary approach on nuclear terrorism is imperative to improve the efficiency of risk-policing.

DISCUSSING NUCLEAR TERRORISM

In general, nuclear terrorism is explored in subfields of terrorism study, broadly in security studies, and largely in international relations. Accordingly, the multi-dimensional aspects of nuclear terrorism are studied in terrorism studies, nuclear proliferation research, criminology, economics, military study and so on. These provide the different aspects that explain nuclear terrorism that are valuable in establishing micro-level risk-policing against

23. "Listing of Terrorist Organisations", Australian National Security, Australian Government, available at http://www.nationalsecurity.gov.au/agd/WWW/NationalSecurity.nsf/Page/What_Governments_are_doingListing_of_Terrorism_Organisations accessed on 15 Oct 12.
24. United Nations Security Council, Letter dated 18 September 2006 from the Chairman of the Security Council Committee established pursuant to resolution 1267 (1999) concerning Al-Qaida and the Taliban and associated individuals and entities addressed to the President of the Security Council, September 20, 2006, S/2006/750 available at http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N06/529/76/PDF/N0652976.pdf?OpenElement.

nuclear terrorism. In the glimpse of nuclear terrorism, different aspects of diagnosis and prognosis are spread across different study areas and interact. Noticeably, many details diverge due to different logics that need to be combined for further research and more effective security measures.

MOTIVATIONS AND STRATEGIC CALCULATIONS

Until now, terrorist groups' motivations of for acquiring nuclear capability differ considerably. In general, in searching for the causes and consequences in terrorism, there is a common acceptance that terrorism needs to be understood by its intentional or circumstantial characteristics, not by the violent act itself.[25] In terrorism research, many agree that the perception parameters for nuclear terror seem to play a critical role that strategic consideration of nuclear terrorism is created and fuelled by terrorist leaders or groups, in justifying ideological rationalisation and strategic calculations. Many in terrorism research state that nuclear terrorism, a part of WMD terror (e.g. chemical, biological, radiological, nuclear and high-yield explosives (CBRNE) terrorism), is a sub-strategic practice of terrorism tactics driven by "hatred, fanaticism, ideological or religious extremism".[26] If correct, then nuclear terrorism cannot be distinguished from other terrorism motivations. Moreover, the strategic position of nuclear terrorism can be compared to the other tactics of terrorism.

International Terrorism: The Attributes of Terrorist Events (ITERATE) data set (1968-2008), composed by Walter Enders and Todd Sandler (2012), provides the general pattern of terror.[27] As the survey points out, all terrorist tactics are categorised into twenty-five types of actions varying from the simple and conventional ways of causing damage to CBRNE terrorism. Generally, bombing tactics constitute a major portion of all terrorist tactics, yet a nuclear-related attack is found to have only happened once in the total of 13,181 terrorist incidents. All-purpose tactics, or general tactics envisaged

25. Richard Jackson (2009), "Knowledge, Power and Politics in the Study of Political Terrorism" in Richard Jackson, Marie Breen Smyth and Jeroen Gunning (eds.), (2009), *Critical Terrorism Study*, New York: Routledge, pp.66-84.
26. Ibid.
27. Walter Enders and Todd Sandler (2012), *The Political Economy of Terrorism*, New York: Cambridge University Press. pp.61-102.

Motivation and strategic calculation of nuclear terrorism varies on how to perceive the characteristics of the actors strategic benefits only by the costs (of security and finance) and effects, despite general terrorism being seen to be boosted

by terrorists tend more towards conventional ways of damaging the target (e.g., purported Weapons of Mass Effect, or WMEs) rather than utilising a nuclear-related weapon which requires a great deal of delicacy. Based on the statistical analysis, one may easily say that the strategic benefit analysis of nuclear terror has less valid in pursuing the complicated discourse of nuclear terrorism preparedness. Simply put, nuclear terrorism costs too much to serve the terrorist aim.

In approaching cost-effectiveness method, logically, the cost of terrorism should not exceed the capability of terrorist groups. If it is overburdened, the group may collapse. It is called risk-averse calculation[28], that the strategy of nuclear terrorism is considered within the margin of cost-affordability. According to this view, the tactics, whether to use conventional skills or WMDs, must help terrorist groups to survive successfully even after they fail to conduct terrorism properly. It is widely supported in nuclear proliferation research, among sceptics in particular, saying that terrorist groups might be willing to be conservative to way in nuclear terrorism path.

However, there is a debate within these studies about whether to set terrorist leaders or groups as rational actors or not to apply cost-effectiveness approach. Since nuclear proliferation research emanated from the realist school, the motivation and strategic calculation of nuclear terrorism varies on how to perceive the characteristics of the actors. According to rational choice theory from the realist school, terrorist leaders will calculate strategic benefits only by the costs (of security and finance) and effects, despite general terrorism being seen to be boosted by religious and ideological motives.

28. According to Michael Levi, "Risk-Averse describes one who chooses an option with less risk failure or of retaliation over an option with more risk of failure or retaliation", Michael Levi (2007), *On Nuclear Terrorism*, Massachusetts: Harvard University Press, p.171.

The assumptions of rational choice theory in terrorists are accepted in criminology as well, extending the view of more participants involved in nuclear terrorism. As a part of the process of nuclear terror, the organised crime within illicit nuclear trade must have occurred between heterogenic criminal groups or individuals. Tracing Al Qaida's global illicit trade to access nuclear materials, criminology states that terrorist groups need to maintain networks with criminals by offering a picture of cost-benefit.[29] Even apart from the Al Qaida network, the lower level of illicit trafficking of nuclear materials is even more complicated within the larger range of smuggling patterns. According to the case study of Chelyabinsk Oblast on nuclear smuggling, it is presumed that a multitude of ill-intentioned groups or personnel were broadly layered and approximately eleven different operators were involved.[30]

Unlike individual-level crime, the actors are participating in a more risky mission like trading nuclear materials, or helping to access nuclear facilities. In criminology, while sharing the information about costs, benefits and the probability of punishment, perhaps religious motivation or regime types may hardly matter for criminal groups, both offences and offenders participated in criminal activity in local area. It infers that the final decision-making to operate nuclear terror must be determined by the top leader of a terrorist group; however, it cannot be asserted that nuclear terrorism is all religious and ideology driven.

Dealing with risk-averse calculations in other two studies, criminology agrees that it is one of the essential parts for sustaining and managing a group. As a priority, reducing conflict of interest, not only at group-level but also at individual amplifies the scope of group management. For survival, it is important to keep an eye on screening mechanisms such as auditing lost money, scrutinising moral hazards in a criminal network and maintaining a carrot-and-stick strategy for compensation. Therefore, criminal experts

29. Lyudmila Zaitseva (2007), "Organized Crime, Terrorism and Nuclear Trafficking", *Strategic Insights*.
30. Robert Orttung and Louise Shelly (2005), "Linkages between Terrorist and Organized Crime Groups in Nuclear Smuggling: A Case Study of Chelyabinsk Oblast", *PONARS Policy Memo,* No. 392. pp.162-163.

constantly raise overlooked questions that the heterogeneity of terrorist-criminal collaboration that would meet and challenge can bring chance to suppress nuclear terrorism.[31]

In economics, the strategic calculation of terrorists is considered to be derived from 'modeling the cost of nuclear terrorism'.[32] Despite its exclusion of factors such as political and religious agenda that drive nuclear terrorism, the 'cost per casualty' model considerably assumes terrorist expense to some extent. Therefore, the model is helpful in establishing risk-policing on the prevention of nuclear terrorism. In strategy studies, some researchers argue that the cost of acquiring nuclear capability and the mass casualty it causes heavily weigh with its deterrent effect. However, the economic approach requires that a comparable, exact amount of building-up nuclear capability should be determined, such as the calculation of terrorists on the cost per casualty. According to this argument, the probable scenario of nuclear terrorism may be changed unlike many presupposed scenarios in which terrorists acquire fissile materials and nuclear devices only through transnational trade. They can even proceed to the nuclear development process within the enemy's own territory, such as in the US, for instance. [33]

Possibility of State-sponsored nuclear terrorism

Recently, a new trend of discovery on state-sponsored terrorism has been identified, which is that punitive action for state-sponsored terrorism is no longer one-sided. In traditional terrorism studies, state-sponsored terrorism was studied regarding the fact that some terrorist groups have been supported or exploited by states.[34] Alternatively, in some cases, it was viewed that state-sponsored terrorism is another form of a state's criminogenic contribution

31. Keith Hayward (2007), "Situational Crime Prevention and its Discontents: Rational Choice Theory versus the 'Culture of Now', *Social Policy & Administration*, 41(3), pp.232-250.
32. Jeffrey G. Lewis (2006), "The Economics of Nuclear Terrorism", FfP Threat Convergence Publications, Fund for Peace (FfP), Washington, DC, United States, p. 3.
33. Jeffrey G. Lewis (2006), "The Economics of Nuclear Terrorism", FfP Threat Convergence Publications, Fund for Peace (FfP), Washington, DC, United States, pp.1–9.
34. Faruk Ekmekci (2011), "Terrorism as War by other Means: National Security and State Support for Terrorism", *Revista Brasileira de Poíitica International*. 54(1), p. 125.

by proxy.[35] Sketching the map of where state-sponsored terrorism is aimed at, the attacks are more frequently demonstrated between on-going inter-state rivalries. According to Justin Conrad (2011), state sponsorship of terrorism is mainly observed between two states who are seeking tactical advantages by using a penetrator's attack as "an alternative to risking full-scale war".[36] The bottom-line is that between two or more rival states, state-sponsored terrorism is "a low-cost alternative to war" containing formal strategic deniability.[37]

Applying nuclear terrorism within the conceptualisation of state-sponsored terrorism, the irregular quality of nuclear terrorism and its probable effectiveness as deterrence is highlighted. During the Cold War, the regular quality of nuclear weapons at state-level had been considered in war plans despite the non-use of the weapons in practice. Later, this view was extended to nuclear terrorism, evolving from the irregular quality of nuclear explosives to be obtained by terrorists.[38] From this point of view, as Graham Allison warns, for example, the Iran-Hezbullah linkage might be used to deter Israel's military option against Tehran or the Iranian government might expect Hezbullah to take action on its own against the U.S. [39] Alternatively the Pakistani Taliban and North Korea's intention to transfer nuclear weapon or material to a third party is in question. In terrorism studies, state-sponsored terrorism will be fulfilled when mutual ideological and political benefits meet in a security domain.

However, in nuclear proliferation literature, the possibility of state-sponsored nuclear terrorism was envisaged as part of proliferation, not only in strategic calculations, but also because of economic benefits. Noticing North Korea's case of experiencing economic hardship, some assert that rogue states can provide for or co-operate with the terrorist groups; the

35. Kristian Lasslett (2012), "State Crime by Proxy", *British Journal of Criminology*, 52(4), pp.705-723.
36. Justin Conrad (2011), "Interstate Rivalry and Terrorism: An Unprobed Link", *Journal of Conflict Resolution* 55(4), p.530.
37. Ibid. pp.529-555.
38. John Mark Mattox (2010), "Nuclear Terrorism: The 'Other' Extreme of Irregular Warfare", *Journal of Military Ethics*, 9(2), pp.160-176.
39. Graham Allison (2004), *Nuclear Terrorism: The Ultimate Preventable Catastrophe*, New York: Times Books/Henry Holt, p.36.

highest bidders acquiring weapon-grade nuclear materials to get economic benefits. However, the opposite view refutes that even rogue states may/will not take an offer from a terrorist group as handed-over nuclear explosives and materials are not returnable. In the worst scenario, it can be used for retaliation against the provider. Remembering the intrinsic attribute of terrorist groups, of maintaining their own political path, it is commonly accepted that terrorist groups are too unpredictable to be holders of nuclear material, in case they fail or their network disintegrates.

Interacting with two studies in criminology, a multi-layered terrorist-criminal nexus is in focus on whether or not to strengthen state-sponsored terrorism in nuclear terror. According to the Illicit Trafficking Database (ITDB), criminal interest in highly enriched uranium or plutonium-related incidents grew sixteen times in 2011 compared to 1993.[40] Most of the cases are for the trade of gram quantities for material samples from unsecured stockpiles. It is assumed that the demand and supply of weapon-usable nuclear material will continue. However, the difficulty is to demonstrate the characteristics of an illegal nuclear market in terms of size and numbers of participants.[41] Organised crime[42] involving nuclear trafficking is, ordinarily, not a single form of illegal activity. With the expectation of a huge profit margin, criminal involvement is assumed to create a multibillion-dollar market.[43] In the Black Sea region, intelligence assumes that an 'unholy alliance' exists in the trading of HEU, with a price of at least 10,000 dollars per gram.[44] Overall, the demand driven-market is propelled by a population of 'amateur criminals, scam artists, and (on [the] demand side) undercover

40. IAEA Illicit Trafficking Database (ITDB) http://www-ns.iaea.org/downloads/security/itdb-fact-sheet.pdf.
41. Ibid.
42. In some literature, the definition of organised crime varies; traditionally, the meaning of organised crime was valid when it contained a corporate structure. Recently, the classical definition has less impact. It encompasses those groups in flexible forms of hierarchical structures as per the criminal objectives or partnerships they engage in. Lyudmila Zaitseva (2007), "Organized Crime, Terrorism and Nuclear Trafficking", *Strategic Insights*, 6(5), available at http://www.kms1.isn.ethz.ch/serviceengine/Files/.../8_**zaitseva**Aug07.pdf.
43. Maj. Gen. Bruce Lawlor (ret.) (2011), "The Black Sea: Centre of the Nuclear Black Market", *Bulletin of the Atomic Scientists*, 67(6), p. 74.
44 Ibid. p. 76.

police and police decoys'.[45]

In criminology, the research of the terrorist-criminal nexus is more imperative than that of state-sponsored terrorism

Keeping in mind that criminal involvement does not always need to carry the commitment of a political-ideological agenda, it is often reported that buyers and sellers are in a mistrust situation, thereby bringing a risk to terrorist groups that have to overcome each step of the smuggling chain, eventually leading to nuclear terror. Encompassing a large extent of terrorist activity with organised crime, criminal networks provide funds in multiple sources, and help terrorist keeping eyes of vigilance away from the regulations. Presumably, each step of the crime, through legitimate or illicit channels, can strengthen the "operational proficiency" and "logistical goal" of terrorist groups, testing its organisational network and criminal capability.[46] Nowadays, the implications of state-funded terror result in more complexity and voluntary terrorist criminal networks, such as for financing, are more amplified. Hence, in criminology, the research of the terrorist-criminal nexus is more imperative than that of state-sponsored terrorism, as state-driven nuclear proliferation seems to be less effective than terrorist-criminal synergy.

Interface with other terrorism tactics

Mostly, the potential type and number of designs of nuclear terror are addressed in much literature in a consensual manner. It is focused on the portability and deceptiveness of appearance of explosive devices, regarding the technological accessibility that terrorist groups can afford. Examples are low-yield devices; gun-types of devices or suitcase nukes, or some possibilities of high-yield explosives for nuclear terrorism were abundantly introduced both in terrorism and nuclear proliferation research.[47]

45 Rensselaer Lee (2003), "Nuclear Smuggling: Patterns and Responses," *Parameters*, (Spring 2003), p. 101.

46. John T. Picarelli and Louise I. Shelley (2007), "Organized Crime and Terrorism", in Jeanne K. Giraldo and Harold A. Trinkunas (eds.) (2007), *Terrorism Financing and State Responses*, California: Stanford University Press, pp. 39-55.

47. Michael Levi (2007), *On Nuclear Terrorism*, Massachusetts: Harvard University Press. Also in Morten Bremer Maerli, Annette Schaper, and Frank Barnaby (2003), "The Characteristics of Nuclear Terrorist Weapons", *American Behavioral Scientists*, 46(6), pp. 727-744.

Emphasising the catastrophic consequences of nuclear terrorism, acquiring nuclear material and its fabrication with an adaptive design of the explosive are the main risks.

Exploring the military technology developing with nuclear terrorism in defence science studies; however, another possibility of nuclear terrorism is raised as a part of aerial terrorism tactics. Despite there being no perfect definition of aerial terrorism, it is broadly accepted that airpower, or an aerial platform, is being used to cause air assaults by terrorist groups.[48] Many warn about terrorists acquiring any kind of aerial platform, bringing a strategic advantage to terrorist groups. At the centre of this discussion is the idea that the risk of nuclear terrorism is predicted to be less preventable if terrorist succeed with both nuclear capability and predominant airpower. For example, among many possibilities on the terrorist wish-list from the cost-effectiveness point of view, Unmanned Aerial Vehicles (UAVs) or Unmanned Combat Aerial Vehicles (UCAVs) are seen as the most viable solutions for carrying WMDs in the future. Dennis Gormley, a senior fellow of the Monterey Institute of International Studies had illustrated in his analysis that the probable consequences will depend on how quickly terrorists acquire such aircraft.[49]

Compared to the terrorist suicide attacks that are most preferred, it is speculated that terrorist groups are interested in such aircraft for a number of reasons; to enhance tactical and practical achievement without sacrificing people; and to decrease the ostensible onus of recruiting and training terrorists, thereby increasing the efficiency of attack. In the 2000s, the trend of terrorist manoeuvres "converting a small airplane into a weapon-carrying UAV" was markedly proved. A Palestinian extremist deployed UAVs loaded with explosives in 2004 and Hezbullah's successful flight over Israeli territory without interception in 2005 brings more hope to terrorists. However, some refute that it is imaginable in the near future, owing to the

48. Ajay Lele and Archana Mishra (2009), "Aerial Terrorism and the Threat from Unmanned Aerial Vehicles", *Journal of Defense Studies*, 3(3), pp. 54-65.
49. Dennis Gormley (2005), "Unmanned Air Vehicles as Terror Weapons: Real or Imagined?" Nuclear Threat Initiative, Analysis, July 1, 2005, available at http://www.nti.org/analysis/articles/unmanned-air-vehicles-terror-weapons/ accessed on 20 Sep 12.

financial and technological difficulties. However, there is little doubt that Al Qaida is also interested in any combination of WMDs with low-flying mini-UAVs or UACVs to intrude into the enemy's territory in the long-term.

In the history of nuclear non-proliferation, focus has usually been directed on the risk-policing of nuclear terrorism as a part of concern in nuclear proliferation research

SYSTEMIC VULNERABILITIES ON RISK-POLICING OF NUCLEAR TERRORISM

At the ground stage, consensual opinions hold that terrorists group like Al Qaida are pining for nuclear parity against enemies, particularly nuclear weapons states. Therefore, security measures for the prevention of nuclear terrorism have always been integrated into concerned states' short- and long-term plans. Specifically, a number of aspects on the risk-policing of nuclear terrorism are laid out as part of concerted efforts against counter-terrorism, counter-proliferation, and prevention of criminal activity. Hence, the prevention of nuclear terrorism is seen as a matter of comprehensively understanding defence systems. An increasing chance of compounding effect based on layered defence[50] or 'defence-in-depth system'[51] is viewed to be much required to remove the possibility of successive attacks by terrorists. In view of the multi-layered aspects of nuclear terrorism from various studies, the opinions on systemic vulnerabilities against nuclear terrorism suggest a number of issues to be addressed because of policy loopholes.

In the history of nuclear non-proliferation, focus has usually been directed on the risk-policing of nuclear terrorism as a part of concern in nuclear proliferation research. States and non-state actors demonstrate different levels of commitment in dealing with the nuclear proliferation issue. At the state level, the rollback in nuclear proliferation was considered an achievement, with bilateral and multilateral negotiations made to eliminate the need to acquire nuclear weapons in exchange for other

50. Michael Levi (2007), *On Nuclear Terrorism*, Harvard University Press: Massachusetts, USA. p. 7.
51. Todd Masse (2010), "Nuclear Terrorism Redux: Conventionalists, Skeptics and the Margin of Safety", *Orbis*, 54(2), p.303.

security or economic incentives, as well as to encourage more states to join the Nuclear Non-proliferation Treaty (NPT).[52] State-level non-proliferation efforts ostensibly seem to be effective because the actors of the supply and the demand sides are known.

In dealing with terrorism, the elimination of terrorist ambition on nuclear terror through the participation of states involves a number of difficulties. For instance, the NTI report (2012) indicates that a lack of political consensus exists in terms of providing financial resources to secure nuclear materials as a part of nuclear terrorism security measure.[53] The financial cooperation of 152 member states to cover the issue has yet to be mandated, whereas the IAEA drew a framework of safeguards, including a list of 15 nuclear materials for civilian use. In the view of nuclear proliferation research, explicit policies are needed in exchange for rewards in the process of architecting global cooperation against nuclear terrorism.[54] Nuclear proliferation research suggests that the hesitation of states to participate in a unified effort can be addressed through the application of the game theoretic solution.

The hope in this view is that the paradoxical situation, which is widely described as the prisoner's dilemma, can be transformed to a coordination game.[55] International cooperation at a legal level is weak, thereby necessitating the active participation of states in the prevention of nuclear terrorism. When the realist assumption meets the cost-effectiveness approach, the logic of coordination sets the assumption that more states are willing to perform a joint task if these states can receive a large payoff when they join a group action. Both at the international and domestic levels, risk-policing against nuclear terrorism require in actual practice a solid understanding of tightened policies. Examples are policies on tracking terrorists' money laundering, freezing their assets, refusing them physical

52. Lewis A Dunn (2007), "Countering Proliferation: Insight from past "Wins, Losses, and Draws" in Peter R. Lavoy (ed.), *Nuclear Weapons Proliferation in the Next Decades*, Routledge. pp.47–58.
53. NTI Nuclear Materials Security Index, January 2012, The Nuclear Threat initiative
54. Graham Allison (2008), "Nuclear Deterrence in the Age of Nuclear Terrorism", *Technology Review*, 111(6), p. 73.
55. Walter Enders and Todd Sandler (2012), *The Political Economy of Terrorism*, New York: Cambridge University Press. pp. 61–102.

and ideological protection, sharing intelligence, building up diplomatic networks among parties and establishing mutual policies. However, several limitations persist in terms of coordination, as suggested by various studies on nuclear terrorism.

Cost of preventing nuclear terrorism is not consensually agreed upon despite a global understanding of the imperative

First, the cost of preventing nuclear terrorism is not consensually agreed upon despite a global understanding of the imperative.[56] Collective diplomacy and substantial financial investment will certainly diminish the massive threat of nuclear terrorism.[57] However, little is known regarding when, where, how many assailants, in what way and with what capabilities terrorists will act.[58] This lack of information hinders when, where, to whom and how investment against nuclear terrorism among states will be made. Terrorism research focuses on determining terrorist groups, nuclear research on nuclear forensics, and criminology on the terrorist–criminal nexus and intelligence analysis on intelligence investment. All of these efforts are imperative, but they are futile if the resources that can be provided by state members are not wisely located.

Second, not all states confront the same levels of terrorism risk, which presupposes their varying levels of commitment.[59] Therefore, it is a matter of who will share more or less of the costs of destroying terrorist facilities, thwarting financial networks and mechanisms of recruiting scientist and engineers, and deploying nuclear detection systems is difficult to determine.

Third, investment in particular terrorist tactics like nuclear terrorism is also in question. The main argument here is how the greater likelihood of nuclear terrorism over terrorism involving WMDs can be estimated.

56. Graham Allison ( ), "Nuclear Deterrence in the Age of Nuclear Terrorism", p. 73.
57. Matthew C. Weinzierl (2004), "The Cost of Living: The Economics of Preventing Nuclear Terrorism", *The National Interest*, Spring 2004, p. 118.
58. Matthew Bunn (2006), "A Mathematical Model of the Risk of Nuclear Terrorism", *The ANNALS of the American Academy of Political and Social Science* 607, September 2006, p. 111.
59. Philp Keefer and Norman Loayza (2008), *Terrorism, Economic Development, and Political Openness*, New York: Cambridge University Press. James Goodby, Timothy Coffey, and Cheryl Loeb (2007), "Deploying Nuclear Detection Systems: A Proposed Strategy for Combating Nuclear Terrorism", Center for Technology and National Security Policy, National Defense University available at http://www.ndu.edu/CTNSP/docUploaded/DTP%2041%20NuclearDetectionStrategy.pdf.

Intelligence reforms or constitutional limitations on intelligence hinder determination on proper action that prevent flexibility of terrorism investigation

Discussing budget allocation of nuclear terrorism is one of the essential parts of an evaluation and reward mechanism in governance.

Fourth, in decision-making on prevention of nuclear terrorism as a part of CBRNE terrorism, both domestic and external issues can impinge upon the budget, so that trends of budgets for counter-terrorism are apt to fluctuation of the financial price tag distracted by other internal factors. In Britain, the hosting of the Olympic game drew the three national agencies' bids for counter-terrorism funding down.[60] In Indonesia, it was announced that the National Counter-Terrorism Agency (BNPT) will cut its budgetary expense derived from the evaluation report on the question of whether it is worth investing, considering past performance.[61] As Indonesia sees, the asymmetrical expenses of nuclear forensics in the world vary risk-policing.

Fifth, the sharing of intelligence information across the world is a one of core concern in terms of handling first-hand information to be used for an issue-based design of nuclear terrorism. Unfortunately, the obtainment of viable intelligence information is often a conflict point, especially when states claim sovereignty over foreign intelligence efforts.[62] While usability of intelligence information is wide-ranged, it also raises a number of woes in practice. The role of intelligence in conducting surveillance and collecting data often meets a challenge when it performs against foreign intelligence or criminal acts. Intelligence assessment on nuclear terrorism in particular is vitally related to national security, yet it might cross far

60. "London 2012: Austerity Cuts to Counter-Terrorism Budget Could Hit UK after Olympic Games", *The Huffington Post*, February 7, 2012. http://www.huffingtonpost.co.uk/2012/02/06/london-2012-big-terrorism_n_1258302.html.
61. "Counterterrorism Risks Faltering on Budget Cut", *The Jakarta Post*, June 11, 2012. available at http://www.thejakartapost.com/news/2012/06/11/counterterrorism-risks-faltering-budget-cut.html.
62. John Scott (2011), "Confronting" Foreign Intelligence: Crawford Roadblocks to Domestic Terrorism Trials", *The Journal of Criminal Law & Criminology*, 101(3), pp.1039–1079. Stephen Sloan, (2002), "Meeting the Terrorist Threat: The localization of Counter Terrorism Intelligence", *Police Practice and Research*, 3(4), pp. 337–338.

beyond legal boundaries or its original purpose. On the other hand, it is said that intelligence reforms or constitutional limitations on intelligence hinder determination on proper action that prevent flexibility of terrorism investigation.[63] It is ongoing discussion of sharing intelligence in domestic and international arenas as it is further complicated by collecting information, in contrast to the compilation by different agencies and nations.[64]

CONCLUSION

The real threat of nuclear terrorism through non-state actors' nuclear proliferation is a primary concern in the international community. While state proliferation can be monitored and sanctioned in a systematic way, nuclear terrorism involves additional factors to ensure domestic and international preparedness. Most states struggle to prevent catastrophic nuclear terror events by implementing unilateral and multilateral risk policing. Fortunately, many see nuclear terror as preventable through securing nuclear material and disrupting technological and criminal networks. Therefore, academics, policy-makers, and the intelligence community keep trying to moderate the defence policy interface using various analyses provided.

It may be true that terrorists that desire the nuclear weapon as an ultimate tool, similar to the state's nuclear pursuits, cannot be stopped due to nuclear states' reluctance toward global nuclear disarmament and the states' desire for advanced nuclear weapons and delivery systems. As long as the symbolic impact of nuclear weapons exists, it is unlikely that terrorists will voluntarily abandon their political goals. Therefore, dealing with nuclear terrorism will cost more and last longer as terrorists' attraction to nuclear terror is not likely to decrease.

Understanding nuclear terrorism requires in-depth and interdisciplinary, long-term analysis. Various studies suggest different approaches to understanding terrorists' motivations and strategic calculations, their desire to potential technical capabilities, and terrorist networks with states and

63. John Scott (2011), ""Confronting" Foreign Intelligence: Crawford Roadblocks to Domestic Terrorism Trials", *The Journal of Criminal Law & Criminology*, 101(3), pp.1039-1079.
64. Stephen Sloan, (2002), "Meeting the Terrorist Threat: The localization of Counter Terrorism Intelligence", *Police Practice and Research*, 3(4), pp. 337-338.

other criminals. Due to the existence of contradictory assumptions and logic regarding nuclear terrorism risk-policing, confusion occurs during policy implementation. In addition, each state faces conflicting situations, which distracts from the establishment of global nuclear governance to prevent nuclear terrorism. The need to face the threat of nuclear terrorism has been sufficiently emphasised, but progress is still far from practical forward movement.

To prevent nuclear terror more effectively, non-nuclear tools combined with a nuclear nonproliferation approach are imperative. While some argue the need for military intervention, this intervention should be a last resort. If used, military intervention may delay a terrorist's plan by hindering the key components of the plan in the short-term, but this intervention can lead to the expansion of the terrorist group due to social hatred and religious extremism against the targeting state. History shows that a unilateral approach to nuclear terrorism causes states to resist the establishment of an integrated global consensus on counter-terrorism and nonproliferation regimes. Therefore, the right strategy should be focusing on effective risk-policing by creating a foundation of the global nuclear policy architecture that provides for the mutual benefit of the joint forces.