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THE LOGIC BEHIND TRILATERAL MODEL FOR IMPLEMENTING THE FIRST NUCLEAR POWER PLANT IN BANGLADESH

Abstract

Development of the first nuclear power plant requires extensive national nuclear infrastructure and international cooperation. Bangladesh's decision to build its maiden nuclear power plant through a trilateral cooperation model is unique in the history of global nuclear power development. Nevertheless, no study has investigated Bangladesh's rationale for forming a trilateral nuclear partnership with Russia and India. This article meets this gap and explores Bangladesh's logic behind trilateral nuclear collaboration to implement the country's first nuclear power project at Rooppur. It finds that politico-strategic, technological, and economic logics have influenced Bangladesh's decision to forge trilateral nuclear arrangement. While Bangladesh's relations with partners, nuclear reputation of partners, and win-win interests for all parties underpin the politico-strategic logic; capacity-building and technical assistance, and cost effectiveness and avoidance of construction delay, have provided ground for technological and economic logic, respectively. The study concludes that a convergence of all three logics have shaped Bangladesh's position to form a trilateral nuclear partnership with Russia and India.

Keywords: Nuclear Energy, Trilateral Cooperation, Bangladesh-Russia-India Relations, Rooppur Nuclear Power Project, Energy Crisis, South Asia.

1. Introduction

By December 2020, there have been 443 nuclear power reactors operational in world's 33 countries, generating around 10 per cent of the world's electricity.[1] This widespread interest in using nuclear power for electricity generation, which has been described as a 'nuclear renaissance', has sprung due to many merits of nuclear power, and increasing demand for energy underpinning economic growth

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[1] IAEA Database on Nuclear Power Reactors, available at https://pris.iaea.org/PRIS/home.aspx, accessed on 25 February 2020.

in the developing world.[2] Of 19 countries, which were actively working to develop nuclear power plants in 2020,[3] Bangladesh is one of them, currently developing the country's first nuclear power plant (NPP).

Since independence, Bangladesh had been facing deficit in its supply of electricity to meet the country's daily needs. Being one of the world's lowest energy consumption countries (512kWh/person/year),[4] Bangladesh has historically relied on fossil fuels for power generation, of which 50 per cent comes from natural gas, following 35 per cent from imported oil, 8 per cent from coal, 5.5 per cent imported from India through regional connectivity, and 1.5 per cent from renewables including hydro.[5] Worryingly, the biggest power supply source 'natural gas' is being depleted fast and believed to be exhausted by next 10-15 years.[6] It is in this context, the incumbent government, after assuming to power in 2009, put highest priority on 'electrification for all' by 2021 to accelerate industrial and economic growth. The government envisions to be a middle-income country by 2021 and a developed country by 2041 that requires 24,000MWe and 60,000MWe supply of electricity, respectively. To achieve these goals, Bangladesh government has adopted the fuel diversification policy. In this connection, the government has adopted nuclear energy as an alternative base-load large electricity source, which can significantly contribute to a country's energy security, due to many reasons i.e.; (a) requirement of a small amount of fuel and space in commercial power reactors; (b) inherent ability of nuclear fuel to breed more fuel during the use;[7] (c) low unit generation costs; (d) stable supplies of uranium in the global market; and (e) ability to supply greenhouse gas-free electricity.[8] Bangladesh's other policies include more use of renewable energies, preferably 10 per cent share of the total electricity generation by 2021, and increasing energy and power trading opportunities from neighbouring and regional countries.

Bangladesh government's decision was also guided by the National Energy Policy 2004, the Renewable Energy Policy of Bangladesh 2008, and the Power

[2] Richard A. Meserve, "The Global Nuclear Safety Regime", *Daedalus – Journal of the American Academy of Arts & Sciences*, Vol. 1, 2009, pp. 100-111.

[3] IAEA Database on Power Reactor Country Statistics, op. cit.

[4] World Population Review, "Energy Consumption by Country", available at https://worldpopulationreview.com/country-rankings/energy-consumption-by-country, accessed on 11 February 2021.

[5] Bangladesh Power Development Board (BPDB), "Annual Report 2018-19", available at https://www.bpdb.gov.bd/bpdb_new/resourcefile/annualreports/annualreport_1574325376_Annual_Report_2018-19.pdf, accessed on 5 February 2021.

[6] Md. Saydur Rahman et al., "Present Situation of Renewable Energy in Bangladesh: Renewable Energy Sources Existing in Bangladesh", *Global Journal of Research in Engineering Electrical and Electronics Engineering*, Vol. 13, No. 5, 2013, p 1.

[7] James E. Platte, "Exporting Nuclear Norms: Japan and South Korea in the International Nuclear Market", *Journal of Indo-Pacific Affairs*, Vol. 3, No. 2, 2020, pp. 127-145.

[8] Richard A. Meserve, op. cit.; also see Richard K. Lester & Robert Rosner, "The Growth of Nuclear Power: Drivers & Constraints", *Daedalus – Journal of the American Academy of Arts & Sciences*, Vol. 1, 2009, p. 21.

System Master Plan (PSMP) 2016, insisted on the use of nuclear energy to ensure a long-term, uninterruptable, affordable and environment-friendly supply of clean energy, and aimed to generate 10 per cent share of the total electricity by harnessing nuclear power.[9] When the total power generation target is estimated to be 24000MWe by 2021 and 40000MWe by 2031, then 10 per cent share of nuclear power stands to 2400MWe and 4000MWe, respectively. Thus, the incumbent government went ahead to develop the country's first NPP at the much-talked historical site, Rooppur, which was selected in early 1960s and is in Pabna district, some 160 kilometers north from the capital. Rooppur site can house 4 reactor units with 1200MWe electric capacity of each unit with total capacity of 4800MWe.

Development of the first NPP requires careful planning, extensive national nuclear infrastructure, trusted nuclear partnerships, and international cooperation. To implement the country's maiden NPP, Bangladesh government first chose Russia as its nuclear vendor and formalized the nuclear bond by signing a Memorandum of Understanding (MOU) in 2009. Bangladesh-Russia nuclear deal aims to produce 2,400 MWe electricity from two reactors, which are expected to be operational by 2024-25.[10] To accomplish the construction of the two reactors, Dhaka and Moscow have signed at least a dozen of bilateral cooperation agreements on various issues in the 2009-2019 period. Despite its bilateral nuclear deal with Russia, Bangladesh has extended its bilateral partnership with India in April 2017 by inking three nuclear cooperation agreements. Engaging with multiple nuclear partners though bilateral arrangements to develop nuclear power plants and to ensure mutually beneficial economic, technical, and security cooperation is a common phenomenon. For instance, India has bilateral civil nuclear cooperation agreements with 14 countries,[11] while Turkey has such bilateral arrangements with 15 countries.[12]

While bilateral nuclear cooperation with multiple partners is common, engaging in trilateral partnership for building NPPs is not very common in the history of global nuclear power development. The reason for this is perhaps that

[9] Ministry of Power, Energy and Mineral Resources (MPEMR), "National Energy Policy", available at https://gtcl.org.bd/wp-content/uploads/2018/02/NATIONAL-ENERGY-POLICY.pdf, accessed on 19 September 2019; Ministry of Power, Energy and Mineral Resources (MPEMR), "Renewable Energy Policy of Bangladesh", available at https://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/laws/1058.pdf, accessed on 27 September 2019; Ministry of Power, Energy and Mineral Resources (MPEMR), "Power System Master Plan 2016", available at https://mpemr.gov.bd/assets/media/pdffiles/FR_PSMP_revised.pdf, accessed on 12 November 2019.

[10] Md. Anwar Hossain, "Power System Master Plan (PSMP) and Nuclear Power in Bangladesh", *First Concrete Pouring of Rooppur Nuclear Power Plant*, Ministry of Science and Technology & Bangladesh Atomic Energy Commission, 2017, p. 30.

[11] Pulkit Mohan & Pallav Ararwal, "India's Civil Nuclear Agreements: A New Dimension in India's Global Diplomacy", *Observer Research Foundation (ORF)*, Issue No. 320, 2019, p. 2; Department of Atomic Energy, "Important Agreements", available at https://dae.gov.in/node/75, accessed on 19 January 2021.

[12] IAEA, "Country Nuclear Power Profiles – Turkey", available at https://cnpp.iaea.org/countryprofiles/Turkey/Turkey.htm, accessed on 23 January 2021.

given the existence of small numbers of globally reputed nuclear vendors with proven technological excellence and the competition among the vendors, most newcomer nuclear countries usually choose nuclear vendors or partners through bilateral arrangements based on geopolitical considerations, economics, preference for a particular nuclear technology, and political relationships which are to be lasted for decades.[13] Thus, for most nuclear newcomer countries, meeting these criteria for choosing nuclear partners bilaterally is preferable to trilateral or multilateral arrangements.[14] However, a good example of trilateral cooperation model is the Hinckley Point C NPP at UK which has been being developed with the financial and technical support of France and China.[15] In 2018, Bangladesh has significantly advanced this trilateral model by signing a tripartite nuclear agreement with Russia and India for developing Rooppur NPP project.

Despite having separate bilateral agreements with Russia and India, Bangladesh's decision to move toward a trilateral nuclear agreement with both partners has added a new chapter in the country's history of electricity and power generation. In this backdrop, this paper investigates Bangladesh's logic for collaborating with India and Russia through trilateral arrangement. Previous studies have either examined the challenges and prospects of nuclear energy for the sustainable development in Bangladesh,[16] or explored the prospects of renewable energy for the future energy security,[17] but no study has investigated the logic behind Bangladesh's decision to ink a trilateral nuclear agreement with Russia and India. This study meets this gap and adds new insights to the existing literature. It finds that a convergence of politico-strategic, technological, and economic logics has driven Bangladesh to forge a trilateral nuclear agreement with Russia and India.

[13] Jennifer T Gordon, "International Co-Financing of Nuclear Reactors between the United States and its Allies", Atlantic Council: Global Energy Center, Issue Brief: January 2020.

[14] Abigail Sah, Jessica Lovering, Omaro Maseli, and Aishwarya Saxena, *Atoms for Africa: Is There a Future for Civil Nuclear Energy in Sub-Saharan Africa*? Washington D.C.: Center for Global Development, CGD Policy Paper 124, 2018, pp. 12-13.

[15] Holly Watt, "Hinkley Point: The 'Dreadful Deal' behind the World's Most Expensive Power Plant", *The Guardian*, 21 December 2017.

[16] P. K. Bhowmik and S. Barua, "Prospect of Nuclear Power Plant in Bangladesh", *Journal of Electrical Engineering*, Vol. 36, No. 2, 2012, pp. 43-48; Ishrak Ahmed Siddiky, "The Rooppur Nuclear Power Plant: Is Bangladesh Really Ready for Nuclear Power?", *The Journal of World Energy Law and Energy*, Vol. 8, No. 1, 2015, pp. 20-25; Ridoan Karim et al., "Nuclear Energy Development in Bangladesh: A Study of Opportunities and Challenges", *Energies*, Vol. 11, No. 7, 2018, pp. 1-15; and Md. Shafiqul Islam and Aynul Islam, "Nuclear Security and Safeguards in Bangladesh: Mapping Risks and Way Out", *International Journal of Nuclear Energy Science & Technology*, Vol. 10, No. 2, 2016, pp. 123-145.

[17] M. Hasan Masud et al., "Renewable Energy in Bangladesh: Current Situation and Future Prospect", *International Journal of Sustainable Energy*, Vol. 39, No. 2, 2013, pp. 132-175; M. F. Hasan, S. Hossain, & M. J. Uddin, "Renewable Energy: Prospects and Trends in Bangladesh", *Renewable and Sustainable Energy Reviews*, Vol. 70, 2017, pp. 44-49; and P. K. Halder, N. Paul, M. U. H. Joardder and M. Sarker, "Energy Scarcity and Potential of Renewable Energy in Bangladesh", *Renewable and Sustainable Energy Reviews*, Vol. 51, 2015, pp. 1636-1649.

While Bangladesh government's relations with partners, nuclear reputation of partners, and win-win interests for all parties underpin the politico-strategic logic; capacity-building and technical assistance, and cost effectiveness and avoidance of construction delay, have provided ground for technological and economic logic, respectively.

The paper is divided into six parts. While the second section describes the research method, the third part provides a brief discussion on origins and progression of nuclear power plant development in Bangladesh. The fourth section highlights Bangladesh's status in upholding the international legal norms and instruments. The fifth part unfolds and explains the three-fold logic of Bangladesh government to forge a trilateral nuclear partnership with Russia and India. The final section summarizes the key findings and offers avenues for future research.

2. Methodology

To explain Bangladesh's logic for trilateral model, this study has used both primary and secondary data. We collected primary data from two sources. First, we have collected and utilized publicly accessible copies of official agreements, legal frameworks, rules and guidelines, and official statements from Bangladesh Atomic Energy Commission (BAEC), Ministry of Science and Technology (MOST), International Atomic Energy Agency (IAEA), Russian State Atomic Energy Corporation (ROSATOM), and India's Department of Atomic Energy (DAE) to bolster our argument.

Second, we have conducted 21 Key Informant Interviews (KIIs) with a wide range of experts in the May-December 2019 period. The interviewees were carefully selected based on their areas of expertise and professional involvement which falls into three categories: key stakeholders involved in the policy circles, academic experts, and journalists and public policy analysts. Several stakeholders were involved in Bangladesh's nuclear decision-making such as MOST, Ministry of Power, Energy, and Mineral Resources (MPEMR), BAEC, ROSATOM, and Rooppur Project Management Unit (RPMU). While academic and technical experts were selected from the Bangladesh University of Engineering and Technology (BUET) and the Military Institute of Science and Technology (MIST), public policy experts were chosen from the University of Dhaka, Prothom Alo, and The Economic Times. Interviewees from each category were selected based on their availability and terms of consent in maintaining ethical integrity with anonymity. The interviews were conducted based on face-to-face and email interview techniques. Additionally, we have consulted relevant books, scholarly articles, policy papers, organizational records, and newspaper analyses for secondary data.

To explore Bangladesh's logic, we employed qualitative research method to analyze both primary and secondary data. We then followed a deductive technique to derive three different logics that worked combinedly behind Bangladesh's decision making: politico-strategic, technological, and economic. To explain these logics, we have utilized both primary and secondary sources to support our arguments. During the study, a major limitation was the dearth of official documents on cooperation agreements due to the confidentiality of the matter. We have offset this limitation by the interview data, which have been cross-checked for validity and reliability.

3. Origins and Progresses in Bangladesh's NPP Development

Before independence, the first initiative to construct NPPs in East Pakistan (now Bangladesh) came from Pakistan Atomic Energy Commission (PAEC) in 1961. Out of 20 possible sites, PAEC selected Rooppur as suitable site, aligning international regulations and practices.[18] The reasons for selecting the Rooppur site include fullest capacity of water flows throughout the year in the Ganges, navigability of the river, stability of riverbank, soil conditions, communication facilities, low population density, and the location of Rooppur, covering electricity network of the northern part of Bangladesh for industrial development.[19]

Although the proposal was approved in 1963 for a 70MWe NPP at Rooppur, it remained unimplemented till the Liberation War 1971. After independence, erstwhile government approved a 125MWe NPP project and conducted a series of feasibility studies with the technical assistance of France, Germany, and Switzerland but the plant was never implemented due to lack of funding and firm political will.[20] The first major political move towards the Rooppur NPP project came in 1996 with the formulation NEP which led to the adoption of Bangladesh Nuclear Power Action Plan 2000 and the incorporation of Rooppur project plan under Annual Development Program (ADP).

In 2005, Bangladesh first signed an agreement with China for 'Cooperation on the Peaceful Uses of Nuclear Energy' for 10 years with an automatic renewal for another five years. At that point, Bangladesh required IAEA's assistance and approval to formally start NPP program. With the formal announcement of NPPs in 2007, Bangladesh received IAEA's approval for the first technical cooperation (TC) program for implementing Rooppur NPP project in 2008. In the same year, government

[18] Ishrak Ahmed Siddiky, op. cit., p. 23.
[19] See Abdul Matin, *Nuclear Power & Rooppur, Issues and Concerns*, Dhaka: Madhyama Media & Publications, First Edition, 2015.
[20] See ASM Ali Ashraf and Md. Shafiqul Islam, "Explaining Public Policy Choices: A Case Study of the First Nuclear Power Plant in Bangladesh", *Strategic Analysis*, Vol. 42, No. 5, 2018, pp. 503-523.

approved an ADP project for 2008-11 cycle titled 'Accomplishment of Essential Activities for the Implementation of Rooppur NPP Project' to carry out preparatory works and development of nuclear infrastructures. Then Bangladesh's main hurdles remained funding and selection of a trusted vendor country for building a national nuclear infrastructure and procuring safe and reliable nuclear reactors. While Russia, China, and South Korea offered both financial and technical assistance to implement Rooppur NPP project, erstwhile Bangladesh government in 2008 reiterated its intention to work with China.[21] However, a change of government in 2009 brought Sheikh Hasina's government into power, which considers both India and China as most important foreign policy partners and given the existence of geopolitical and security dynamics including the Sino-Indian regional power struggle, her government seeks to maintain an equidistance from both partners.[22] Along with this calculation, Hasina government's intention to revitalize Bangladesh-Russia relationship which decayed significantly in the post-Mujib era and Russia's unparalleled leadership in the global NPP development might have pushed Bangladesh to prefer Russia.[23]

Bangladesh formalized its nuclear cooperation with Russia in 2009 by signing an MOU with Atomstroy export (JSC) of ROSATOM on 'Cooperation of Peaceful Uses of Nuclear Energy', which was eventually followed by a series of cooperation agreements with Russia. In 2013, the incumbent formed the Bangladesh Atomic Energy Regulatory Authority (BAERA) to ensure design, construction, commissioning, and operation and radiation safety. To help Bangladesh in developing a strong regulatory body, the FSUE VO "safety" (a technical support organization of Russian regulatory body – Rostechnadzor) has been providing consultancy services to BAERA, as per a 2017 Bangladesh-Russia agreement.[24]

Meanwhile, Bangladesh formed the 'Nuclear Energy Program Implementing Organization' (NEPIO) in 2010 following the IAEA milestones approach. The role of the NEPIO is to provide necessary policy directives to national committee, technical committee, working and sub-working groups for the development of a national nuclear infrastructure.[25] Under the guidance of the 'Bangladesh Nuclear Power Plant Act 2015' and the 'Executive Committee of the National Economic

[21] World Nuclear Association, "Nuclear Power in Bangladesh", available at https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/bangladesh.aspx, accessed on 27 February 2021.
[22] See Lailufar Yasmin, "India and China in South Asia: Bangladesh's Opportunities and Challenges", *Millennial Asia*, Vol. 12, No. 3, 2019, pp. 322-336; also see Md. Abdul Mannan, *Bangladesh-China Relations: Mapping Geopolitical and Security Interests*, Dhaka: The East West Center, University of Dhaka, 2018, p. 6.
[23] Joyeeta Bhattacharjee, "Bangladesh-Russia Nuclear Deal", available at https://www.orfonline.org/research/bangladesh-russia-nuclear-deal/, accessed on 1 March 2021.
[24] Dmitri Samokhin, "Rooppur Nuclear Power Project and Russia's Involvement", *The Daily Sun*, 29 October 2019.
[25] IAEA, *Milestones in the Development of a National Infrastructure for Nuclear Power*, No. NG-G-3.1 (Rev.1), Vienna: International Atomic Energy Agency, 2015.

Council (ECNEC)', the project is now under construction. Realizing the complexity involved in the project, Bangladesh signed three nuclear cooperation agreements with India in 2017. They are – the intergovernmental agreement on 'Cooperation in the Peaceful Uses of Nuclear Energy'; the inter-agency regulatory body agreement between the Atomic Energy Regulatory Board (AERB) of India and its Bangladeshi counterpart BAERA on 'Exchange of Technical Cooperation and Cooperation in the Regulation of Nuclear Safety and Radiation Protection'; and the agreement on 'Cooperation Regarding Nuclear Power Plants in Bangladesh'.[26] Through these agreements, Bangladesh seeks to receive broadly capacity-building assistance for developing infrastructure, supply chain, and human resource; and technical support through expert services, sharing knowledge and expertise on various issues including nuclear safety, radiation protection, waste management, and emergency preparedness to implement the Roopur NPP project in a successful and sustainable manner.[27]

Additionally, Bangladesh has inked a tripartite nuclear cooperation deal with India and Russia in 2018. The trilateral agreement has set a framework for interaction of policymakers and experts among Russia, India, and Bangladesh for implementing the Russian-built NPPs in Bangladesh. Under the agreement, three parties will cooperate in the field of personnel training and mentoring, reviewing and developing regulatory documents, exchange of experience, and consultancy support.[28]

4. International Nuclear Regime and Bangladesh's Status

President Eisenhower's 'Atom for Peace' program in 1953 to assist the developing countries in their development of civilian nuclear energy in exchange of their guarantees for peaceful use led to the creation of an international nuclear regime. Founded in 1957, the International Atomic Energy Agency (IAEA) has fostered the development of an international regime that establishes a general presumption to be upheld by both old and new nuclear and non-nuclear countries. International regime refers to a set of norms, rules, and procedures that have powerful impacts on

[26] Hina Pandey, "India-Bangladesh Nuclear Cooperation: Way Ahead for Nuclear Power in South Asia", *Nuclear Asia*, 29 November 2017.

[27] See Article 5, 'Peaceful Use', Agreement between the Government of the Republic of India and the Government of the People's Republic of Bangladesh on "Cooperation in the Peaceful Uses of Nuclear Energy", Department of Atomic Energy, Government of India; See Article 2, 'Purpose', Arrangement between Atomic Energy Regulatory Board (AERB) and Bangladesh Atomic Energy Regulatory Authority (BAERA) for the "Exchange of Technical Information and Cooperation in the Regulation of Nuclear Safety and Radiation Protection", Ministry of External Affairs, Government of India; See Inter-Agency Agreement between Global Centre for Nuclear Energy Partnership (GCNEP) and Bangladesh Atomic Energy Commission (BAEC) on "Cooperation Regarding Nuclear Power Plant Projects in Bangladesh", Ministry of External Affairs, Government of India.

[28] Dipanjan Roy Chowdhury, "India, Russia, Bangladesh Sign Tripartite Pact for Civil Nuclear Cooperation", *The Economic Times*, 1 March 2018.

the behaviour of states.[29] Although international regimes are seldom perfect, their existence and influence can be measured by their acceptance by states and their ability to constrain the behaviour of such states.[30]

While a variety of norms of international nuclear regime can be traced, three core norms i.e., Nuclear Safety (S), Nuclear Security (S), and Nuclear Safeguards (S), are most significant when it comes to developing civilian nuclear power, as enshrined in the international legal instruments and the IAEA's milestones approach.[31] Together known as 3S, these three norms are located at the core of IAEA's guideline for developing national nuclear infrastructure by addressing 19 issues.[32] IAEA defines 'nuclear safety' as the achievement of the proper operating conditions, the prevention of accidents or mitigation of accident consequences, and the protection of workers, the public, and the environment from undue radiation hazards.[33] With the aim to protect people and environment from any nuclear security events, 'nuclear security' is defined as the detection and the prevention of, and response to, theft, sabotage, unauthorized access, illegal transfer, or other malicious acts involving nuclear material, and other radioactive substances or their associated facilities.[34] Similarly, 'nuclear safeguards' refer to a set of technical measures applied by the IAEA on nuclear material and activities, through which the IAEA seeks to independently verify that nuclear facilities are not misused, and nuclear material is not diverted from peaceful uses.[35] Through safeguards, a country must make sure that all nuclear materials are accounted for and protected and there is no risk of proliferation in any kind.[36]

[29] Robert O. Keohane and Joseph S. Nye, *Power and Interdependence*, Boston: Little Brown, 1977.
[30] Joseph S. Nye, "Maintaining a Nonproliferation Regime", *International Organization*, Vol. 35, No. 1, 1981, pp. 15-38.
[31] Johan Rautenbach, Wolfram Tonhauser and Anthony Wetherall, "Overview of the International Legal Framework Governing the Safe and Peaceful Use of Nuclear Energy: Some Practical Steps", in IAEA ed. *International Nuclear Law in the Post-Chernobyl Period*, NEA No. 6146, Paris: The Organization for Economic Cooperation and Development (OECD), 2006; and IAEA, *Milestones in the Development of a National Infrastructure for Nuclear Power*, IAEA Nuclear Energy Series No. NG-G-3.1. (Rev. 1), Vienna: International Atomic Energy Agency, 2015.
[32] The 19 nuclear infrastructure issues include: national position, nuclear safety, management, funding and financing, legal framework, safeguards, radiation framework, regulatory framework, electrical grid, human resource development, stakeholder involvement, site and supporting facilities, environmental protection, emergency planning, nuclear security, nuclear fuel cycle, radioactive waste management, industrial involvement, and procurement. For details, see IAEA, 2015, op. cit.
[33] Nasiru Imam Zakariya and M.T.E. Kahn, "Safety, Security, and Safeguard", *Annals of Nuclear Energy*, Vol. 75, 2015, pp. 292–302; IAEA, 2015, op. cit., p. 2.
[34] Nasiru Imam Zakariya and M.T.E. Kahn, op. cit.; IAEA, 2015, op. cit., p. 2.
[35] Nasiru Imam Zakariya and M.T.E. Kahn, op. cit.; also see National Nuclear Security Administration (NNSA), *Introduction to International Safeguards*, Washington D.C.: Office of Nonproliferation and Arms Control (NPAC), 2017.
[36] IAEA, 2015, op. cit., p. 2.

IAEA provides advisory services to ensure that the NPP developing countries abide by these norms while developing a national infrastructure for nuclear power.[37] Although maintaining nuclear safety and security is entirely state's responsibility, the matters of nuclear safeguards are ensured by the IAEA in cooperation with the state.[38] Generally the 3S norms are implemented by international legal instruments and signatories of 3S instruments are required to transform the international obligations into national legislation and regulatory frameworks to maintain the nuclear facilities in a safe and secured manner. Table 1 shows the status of Bangladesh in abiding by the international legal instruments to uphold the 3S norms.

Table 1: International Legal Instruments Regarding 3S and Bangladesh's Status

3S	Title of the Instrument	Came into Force	Binding/ Nonbinding	Bangladesh's Status
Nuclear Safety	Convention on Nuclear Safety	24-Oct-1996	Binding	Party
	Convention on Early Notification of a Nuclear Accident	7-Feb-1988	Binding	Party
	Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	7-Feb-1988	Binding	Party
	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	Yet to force	Binding	Non-party
	Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage	Yet to force	Binding	Non-party
	Convention on Supplementary Compensation for Nuclear Damage	Yet to force	Nonbinding	Non-party
Nuclear Security	Convention on the Physical Protection of Nuclear Materials (CPPNM)	June-2005	Binding	Party
	Amendment to the CPPNM 2005	July-2017	Binding	Party
	International Convention for Suppression of Acts of Nuclear Terrorism (ICSANT)	7-July-2007	Binding	Party
	United Nations Security Council Resolution (UNSCR)-1540	April-2004	Binding	Party

[37] IAEA, *Developing Infrastructure for New Nuclear Power Programmes: IAEA Services for Member States*, Vienna: International Atomic Energy Agency, 2014.
[38] Nasiru Imam Zakariya and M.T.E. Kahn, op. cit.; NNSA, 2017, op. cit.

Nuclear Safeguards	Treaty on the Non-Proliferation of Nuclear Weapons (NPT)	31-Aug-1979	Binding	Party
	Application of Safeguards in connection with NPT	11-June-1982	Binding	Party
	Protocol Additional to the Safeguards Agreements in connection with NPT	30-Mar-2001	Binding	Party
	Improved Procedures of Designation of Safeguards Inspectors	25-Apr-1995	Binding	Party
	Comprehensive Nuclear-Test-Ban Treaty (CTBT)	8-Mar-2000	Binding	Party

Source: IAEA, "Factsheets: Bangladesh".[39]

As Table 1 indicates, Bangladesh complies all 3S related international instruments except the 'Joint Convention on the Safety of Spent Fuel and Radioactive Waste Management' and the 'Convention on Civil Liability for Nuclear Damage.' Besides being party to the 3S instruments, Bangladesh has been maintaining a good record in implementing these norms.[40] Following the IAEA's INIR (Integrated Nuclear Infrastructure Review) mission's recommendations during the phase-wise inspections in 2011 and 2016, Bangladesh has made significant progresses especially strengthening legislative and regulatory framework, integrated work plan, environmental protection, and workforces for maintaining the 3S norms.[41] Additionally, one major move in implementing the 3S was the formation of nuclear security and physical protection system cell under the Bangladesh Army in 2017, which is now building nuclear security infrastructure including nuclear security forces with the cooperation of BAERA and the law enforcing agencies.[42]

It is important to note that for forging bilateral or trilateral ties with nuclear partners, a country must be a signatory of the international legal instruments mentioned in Table 1. Both Bangladesh and Russia are committed to uphold the 3S norms of international nuclear regime in the Rooppur project, as enshrined in Article 7 to Article 15 of the 2011 Bangladesh-Russia intergovernmental agreement on the 'Cooperation Concerning the Construction of an NPP on the Territory of Bangladesh'[43] and in the 2009 agreement on 'Cooperation on the Peaceful Use

[39] IAEA, "Factsheets: Bangladesh", available at https://www.iaea.org/resources/legal/country-factsheets, accessed on 15 February 2021.
[40] Md. Shafiqul Islam and Md. Aynul Islam, op. cit.
[41] Md. Shafiqul Islam, Shafiqul Islam Faisal and Sadia Khan, "Development and Strengthening of the Nuclear and Radiation Safety Infrastructure for Nuclear Power Program of Bangladesh", *Journal of Nuclear Engineering and Technology*, 2020.
[42] ABM Faruquzzaman, "An Approach to Human Resource Development of Nuclear Security Force: Bangladesh Perspective", *National Defence College (NDC) Journal*, Vol. 01, No.1, 2020.
[43] Ministry of Science, Information, and Communication Technology (MOSICT), *Agreement between the Government of Russian Federation and the Government of the People's Republic of Bangladesh on*

of Nuclear Energy'. Similarly, Article 5, 6, and 7 of the 2017 Bangladesh-India agreement on the 'Cooperation in the Peaceful Use of Nuclear Energy' highlight the commitment in upholding the 3S in the Rooppur project.[44]

As the sections above indicate, Bangladesh is committed to uphold the 3S norms of international nuclear regime and in its nuclear partnerships. However, as these norms have been committed through bilateral agreements with Russia and India, then the question arises on what has driven Bangladesh to forge a trilateral agreement with the same partners. Thus, the next section explains Bangladesh's logic for forming a trilateral partnership in constructing the Rooppur project.

5. Logic behind Trilateral Nuclear Collaboration

This section analyzes Bangladesh's three logics for forging a trilateral nuclear cooperation with Russia and India. The three logics i.e., politico-strategic, technological, and economic, which have converged to drive Bangladesh's decision for the trilateral nuclear model, are discussed as follows:

5.1. *Politico-Strategic Logic*

The politico-strategic logic is three-fold: Bangladesh' relations with partners, nuclear reputation of partners, and win-win interests for all parties. First, the ruling government's historical ties and current cordial bilateral relations with Russia and India make them a good fit for a trilateral partnership. The foundation of Bangladesh-Soviet Union (now Russia) relations was laid by the Bangabandhu Sheikh Mujib government back in the 1970s, but the relationship began to deteriorate after Bangabandhu's assassination in 1975 as successive governments changed their courses in the conduct of Bangladesh's foreign policy.[45] Since 2009, Sheikh Hasina government led off to restore the historical ties which has reached today at its height of all time. For instance, the bilateral trade volume between Bangladesh and Russia jumped to US$ 1.4 billion in 2016 compared to only US$ 400 million in 2003-2005 period.[46] Being a key development partner, Russia's cooperation with Bangladesh encompasses a wide array of areas e.g., nuclear energy, military hardwire supplies,

Cooperation Concerning the Construction of a Nuclear Power Plant on the Territory of the People's Republic of Bangladesh, Dhaka: MOSICT, Government of the People's Republic of Bangladesh, 2014.

[44] Ministry of External Affairs, *Agreement between the Government of the Republic of India and the People's Republic of Bangladesh on Cooperation in the Peaceful Use of Nuclear Energy*, New Delhi: MEA, Government of the Republic of India, 2017.

[45] Drong Andrio, "The Effects of Political Changes in the Relationship between Bangladesh and Russia (USSR) in 1971-2014", *Bulletin of the People's Friendship University of Russia*, No. 1, 2015.

[46] Anu Mahmud, "Bangladesh-Russia Cooperation", *The Independent*, 27 December 2017.

trade and commerce, exploration of oil and gas, agriculture, education, health, culture, justice, and counterterrorism.[47] Considering the longstanding and expansive bilateral relations, Bangladesh finds Russia as a suitable partner for trilateral model which will also take the current relations one-step ahead. According to a veteran nuclear energy expert, "Developing nuclear power plants requires to tie with partners for a long period of time for which there is no better alternative to Russia for Bangladesh….the trilateral agreement is an assurance for that."[48] Many respondents have agreed to this narrative.

Similarly, Bangladesh's historical attachment with India, particularly the latter's support for the former's Liberation War, its geographical proximity with the latter, and current Dhaka-Delhi cordial relations, makes India a suitable option for trilateral collaboration. A seasoned energy expert claims that "Considering geopolitical location and current political relations between the countries, India is best to be chosen as a trilateral nuclear partner for Bangladesh."[49] The current cordial ties between the two neighbours is a result of a transformation in the bilateral relationship, in which Bangladesh has widely engaged with India in various fields of cooperation including energy.[50] For instance, Bangladesh currently imports 1160 MWe from India, of which 1000 MWe from Bheramara and 160 MWe from Tripura. Another underway initiative is to import 500 MWe through Cummilla. In 2019, Bangladesh has signed an agreement to further import 1496 MWe which will pass through Chapainawabganj from India's Jharkhand. Moreover, Bangladesh is constructing the South Asia's first cross-border grid 'Baharampur (India)-Bheramara (Bangladesh)' for importing 500 MWe and has also launched joint venture initiative with India for a 1320 MWe ultra-super critical coal-fired thermal power plant at much talked Rampal site. Based on the geographical proximity and the existing electricity trade, it makes sense for Bangladesh to prefer India as a suitable nuclear partner for trilateral model over China, France, Germany, or South Korea.

India has the capacity to significantly contribute to skill transfer and supply of non-critical materials in the Rooppur project. A notable atomic energy specialist noted, "Bangladesh's selection of India as a trilateral nuclear partner was based on the convergence of Dhaka's current relations with Delhi and the quest of the latter's expertise in the Rooppur NPP."[51] Some experts believe that the location of NPPs also mattered here, as Rooppur is close to India's border with only less than two-hours

[47] Ibid. Also see Rupak Bhattacharjee, "Growing Russia-Bangladesh Ties and Their Implications for South Asia", *Society for Policy Studies (SPS)*, No. 1, 2015.
[48] BUET Interviewee – 1, 2019.
[49] BUET Interviewee – 2, 2019.
[50] Md. Sohel Rana, "Transformation of Indo-Bangladesh Relations: From Insecurity to Cooperation in Northeast India", *Strategic Analysis*, Vol. 42, No. 6, 2019, pp. 559-577.
[51] MIST Interviewee – 2, 2019.

ride. According to an energy analyst, "Due to plant location, Rooppur is equally important for India."[52]

Second, along with the existence of trusted bilateral relations, the nuclear reputation of partners has played an influential role in driving Bangladesh's decision for the trilateral model. Russia's global ascendancy as an independent NPP vendor and unparalleled experience in building nuclear reactors abroad under the Engineering, Procurement, and Construction (EPC) contract basis is lucrative to new nuclear power countries. With 7 reactors under construction and 22 more reactor exports (either contracted or ordered), Russia is currently the world's leading nuclear reactor exporter.[53] Presently building NPPs in 12 different countries, Russia has much greater longstanding international presence compared to other nuclear exporters such as China which has entered the international nuclear export market more recently.[54] Only Pakistan has imported six Chinese reactors, of which four are operational units and two units are under construction.[55] Although China has made an early offer to Bangladesh, Russia's global expanse and efficiency is more attractive to Bangladesh.[56] Additionally, Russia is committed to deliver the AES-2006 model VVER-1200 generation 3+ reactors, a model that is regarded as one of the world's best reactors and Russia's latest and safest reactor, capable of ensuring high-performance, cost-effectiveness, reliability, and durability.[57] Thus, it makes sense for Bangladesh to lean toward Russia for trilateral partnership leaving behind other reactor exporters.

Likewise, India has maintained good reputation in designing, constructing, and operating NPPs. India has decades-long proven experiences in building NPPs and has been increasingly using nuclear power for generating electricity.[58] India's journey toward NPP started in 1950s and had established the first commercial nuclear power station, Tarapur Atomic Power Station, in 1962. With 22 nuclear power reactors producing 3.6 per cent of the country's total electricity, India is now currently building 6 new reactors and is expecting to generate 25 per cent of electricity from all these reactors by 2050.[59] Additionally, following the guidelines of

[52] BUET Interviewee – 3, 2019.
[53] James E. Platte, op. cit., p.127.
[54] Mike Crapo, Robert F. Ichord, Randolph Bell, Jennifer T. Gordon, and Ellen Scholl, "The International Context of Civilian Nuclear Power", in Atlantic Council Taskforce ed. *US Nuclear Energy Leadership: Innovation and the Strategic Global Challenge*, Washington, D.C.: The Atlantic Council, 2019, p. 10.
[55] James E. Platte, op. cit., pp. 127-128.
[56] ASM Ali Ashraf and Md. Shafiqul Islam, op. cit., pp. 508-509.
[57] ROSATOM, *The VVER Today: Evolution, Design, Safety*, Moscow: ROSATOM Overseas, 2013.
[58] Nuclear Energy Institute (NEI), "Top 15 Countries Nuclear Generating Countries – By Generation", available at https://www.nei.org/resources/statistics/top-15-nuclear-generating-countries, accessed on 11 February 2021.
[59] World Nuclear Association, "Nuclear Power in India", available at https://www.world-nuclear.org/information-library/country-profiles/countries-g-n/india.aspx, accessed on 19 December 2020.

the UNSC Resolution 1540 for domestic architecture and export controls, India has developed a reliable nuclear governance system.[60] Although India is yet to develop a strong independent nuclear regulatory authority as highlighted by the IAEA's Integrated Regulatory Review Service (IRRS); it has established the Atomic Energy Regulatory Board (AERB) under the DAE, the Nuclear Controls and Planning Wing (NC&PW), and the Global Centre for Nuclear Energy Partnership (GCNEP), which monitor nuclear safeguards, export controls, safety, and security-related issues.[61] India's reputation in constructing NPPs and establishing a reliable nuclear governance system is attractive to Bangladesh, as the latter seeks guidance from the former to successfully develop NPPs. Thus, India's nuclear image along with the currently trusted Dhaka-Delhi relations, makes it a better choice for Bangladesh for the trilateral partnership.

Third, the prospects for win-win interests for all parties have played a leading role in inking the trilateral partnership. For Bangladesh, the ruling government has a political stake in addressing the huge energy deficit in Bangladesh since it made a political commitment to produce 24,000MWe by 2021, as highlighted in its Election Manifesto of 2008, 2013, and 2018.[62] It also reiterated the same claim in its Vision 2021 document.[63] Therefore, it has become a serious domestic matter for the incumbent. According to a renowned International Relations (IR) expert, "Prime Minister has a particular political interest in extending electricity coverage to those who lack it. Failing to do so might upset the public and eventually erode her government's popularity. Thus, the government has engaged in multiple partnerships with two of her most reliable allies for the successful completion of Rooppur NPP."[64]

Additionally, engaging with regional power like India and extra-regional power like Russia, Bangladesh's ruling government aims to meet the country's future energy needs of 40000MWe and 60000MWe by 2030 and 2041 respectively, by trading energy and power especially coal, liquid gas, and electricity import through advancing regional energy cooperation. Bangladesh government is presently negotiating to import at least 3500 MWe electricity through bilateral, regional, and sub-regional joint venture initiatives from India, Myanmar, Nepal, and Bhutan by 2030. Regarding this, a former bureaucrat stated, "Electricity transmission

[60] Adil Sultan, op. cit., pp. 86-87.
[61] Ibid.
[62] Bangladesh Awami League, *Election Manifesto of Bangladesh Awami League-2008*, Dhaka: Bangladesh Awami League, 2008; Bangladesh Awami League, *Election Manifesto of Bangladesh Awami League-2013*, Dhaka: Bangladesh Awami League, 2013; and Bangladesh Awami League, *Election Manifesto of Bangladesh Awami League-2018*, Dhaka: Bangladesh Awami League, 2018.
[63] Centre for Policy Dialogue (CPD), *Bangladesh Vision 2021*, Dhaka: Centre for Policy Dialogue (CPD), 2007, p 15.
[64] IR Interviewee – 1, 2019.

from neighbours is part of the government's plan of promoting regional energy connectivity".[65] Also, an IR expert claims, "Regional cooperation is a key factor here. Under the Bay of Bengal Multi-Sectoral Technological and Economic Cooperation (BIMSTEC), we have multi-national power grid to share surplus electricity with each other. Unlike the South Asian Association for Regional Cooperation (SAARC), India is serious about BIMSTEC due to its 'Look East Policy'. Cooperating with India in nuclear plant, Bangladesh wants to strategically connect India bilaterally and trilaterally and promote regional energy cooperation."[66]

Furthermore, Bangladesh is now the third country in South Asia after India and Pakistan to harness nuclear power to meet her energy needs. Bangladesh's participation in the tripartite nuclear pact with Russia and India creates a new horizon for building new relationships related to nuclear cooperation for peaceful use of nuclear technology. Being a South Asian country, Bangladesh's participation in the agreement bears great political significance in the region and beyond. According to a chemical energy specialist, "For the incumbent government, the Rooppur NPP is a need-based and prestige project. Involving India and Russia in its NPPs through trilateral cooperation, Bangladesh wants to be an example in the region as well as in the world."[67]

In case of Russia, the tripartite nuclear agreement also bears great significance. Russia wants to keep continuing its global nuclear leadership by extending support for energy cooperation abroad through regional and international energy networks. A senior ROSATOM official upheld this view: "The trilateral agreement is the first step toward the formation of a new energy cooperation framework in South Asia".[68] Russia's seriousness for regional framework manifested with the establishment of a regional centre in Mumbai to strengthen partnerships with Indian companies and coordinate Russian bilateral and trilateral projects in Bangladesh. Additionally, Russia is building NPPs in Bangladesh on an 'EPC' contract basis meaning it will be responsible for the completion of the project and be liable during the warranty period. Because of the trilateral agreement, India can help lessen Russia's workload by sharing construction activities. Indicating the likelihood of future technological challenges, an atomic energy expert stated that, "In the long journey of building NPPs, Russia will be responsible for the design of the plants, supply of equipment, construction and commissioning of the plants, human resource development, transferring and maintenance of the technology for reactor operation, waste management, and takeback spent fuel. In case of any

[65] MPEMR Interviewee – 1, 2019.
[66] IR Interviewee – 2, 2019.
[67] BUET Interviewee – 3, 2019.
[68] ROSATOM Interviewee – 3, 2019.

problem, as per the tripartite agreement, India will be of immediate assistance instead of Russia".[69]

As per India's interests from the trilateral partnership, India wants to be a member of the Nuclear Suppliers Group (NSG), often referred as the 'London Club', a group of 48 states seeking to prevent nuclear proliferation through the implementation of NSG guidelines for nuclear export controls. India's previous attempt to join the club failed due to the opposition from a few countries, particularly China, who opposed India's call since India is not a signatory of the non-proliferation treaty (NPT). However, its appeal for NSG membership has been advanced by its compliance to the IAEA Additional Protocol for the Non-Proliferation and the US-India Nuclear Deal 2008 which helped Delhi to receive a 'clean waiver' in the NSG table. The waiver gives India legal right under the international nuclear regulatory regime to trade civil nuclear materials and equipment for peaceful purposes. India wants to utilize this waiver for its maiden nuclear venture abroad to supply non-critical nuclear materials to the Rooppur project. Success in this project under Russia's leadership will certainly enhance India's position as a deserving member of NSG.[70] It will also induce India's credibility to other countries e.g., Sri Lanka, Malaysia, Thailand, Vietnam, and Indonesia, for whom India can be a potential regional nuclear energy supplier in future.

Additionally, India wants to strengthen the capacity of its nuclear industries by gaining experience abroad, and Bangladesh's Rooppur project gives that opportunity to India. India's Kundankulam project is using Russian VVER-1000 model reactors while the Rooppur project has been building Russian VVER-1200 model reactors, an upgraded version of VVER-1000. Since Indian companies are supplying necessary equipment to the Kudankulam project, which is identical to the Rooppur project, similar designs and technologies can be productively used in Bangladesh, making it a win-win gain for both countries. Having ROSATOM as the only vendor in both Kundankulam and Rooppur, India finds it comfortable to move ahead on its first NPP venture in Bangladesh through bilateral and trilateral agreements on Russia's presence. Success in the current project might give India the opportunity to be a nuclear energy supplier for Bangladesh in future, while also enhancing the expertise of Indian nuclear industries.

5.2 *Technological Logic*

The technological logic behind Bangladesh's decision for trilateral nuclear collaboration includes capacity-building assistance and technical assistance. First,

[69] BAEC Interviewee – 3, 2019.
[70] Rafiqul Bashar and Ritu Sharma, "Tripartite Agreement on Rooppur Nuclear Power Plant a Good Start for India: Experts", Nuclear Asia, 3 March 2018.

Bangladesh seeks to harness nuclear power to meet the country's current and future energy needs. It has already declared plans to establish its second NPP in the southern part of the country.[71] Therefore, the country requires to build its capacity in administrative and skilled workforce for NPP construction. BAEC, as a key stakeholder, will work closely with Russia's JSC and India's DAE regarding nuclear safety, radiation safety, waste management, and decommissioning. BAEC seeks to gain expertise on these areas to be used for Bangladesh's future NPP development program. A former chairman of BAEC claims that, "While Russia has world class skills in managing nuclear facilities, India has also developed significant skills in technological areas. BAEC seeks to achieve certain skills from these partners for its future NPPs. Apart from bilateral agreements, the trilateral agreement will give BAEC the experience and skills of a novel cooperation model."[72]

Bangladesh lacks sufficient human resource expertise required for NPP construction which is to be developed with foreign expertise in three phases as per IAEA's milestones approach.[73] For human resource development, Russia will provide training to nearly 1500 workforces for the two units[74]. Currently, about 436 fresh graduates who were recruited by the Nuclear Power Plant Company of Bangladesh Limited (NPCBL) in different science and engineering disciplines, are now undergoing technical training phase by phase in Russia.[75] Besides Russia, India is committed to provide capacity-building training and expert services for implementing the Rooppur NPP project.[76] The Nuclear Power Corporation of India Limited (NPCIL) has already launched series of six-week long courses for BAEC's young scientists and engineers.[77] A nuclear energy scientist says that "Bangladesh has zero expertise in building NPPs. We do not know what kinds of manpower and skill development training are needed. By partnering Russia and India bilaterally and trilaterally, Bangladesh wants to develop its human resource."[78] A senior official at MOST also claims that "Our engineers and professionals are already receiving manpower training and scholarship programs in Russia and India for capacity-building purposes based on bilateral agreements. We want to develop our own manpower as we cannot remain foreign-dependent for long. The trilateral agreement is an added assurance for Bangladesh in this aspect."[79]

[71] IAEA, "Country Nuclear Power Profiles—Bangladesh", available at https://cnpp.iaea.org/countryprofiles/Bangladesh/Bangladesh.htm, accessed on 22 June 2019.
[72] BAEC Interviewee – 1, 2019.
[73] IAEA, 2015, op. cit., pp. 39-41.
[74] IAEA NES No. NG-T-3.10, Workforce Planning for New Nuclear Power Programmes.
[75] ROSATOM Interviewee – 1, 2019.
[76] "India, Bangladesh ink three agreements on nuclear energy in second such deal", *Energy World*, 9 April 2017.
[77] "Foundation Course on Nuclear Energy", Nuclear Power Corporation of India Limited, Department of Atomic Energy.
[78] MIST Interviewee – 1, 2019.
[79] MOST Interviewee – 2, 2019.

Second, Bangladesh seeks huge technical assistance from its nuclear partners. For infrastructural development in Rooppur, BAEC and JSC have been working to undertake preparatory works such as conducting site feasibility studies and environmental impact assessment, developing project design, and initiating construction of reactors. Moreover, Russia has agreed to provide appropriate technologies in managing nuclear wastes, generating from NPP operation to decommissioning stages, and take back about 25 ton spent fuel per year from each reactor.[80] Similarly, India will also provide civil technical assistance for the construction of Rooppur project, as articulated in Article 5 of the 'Cooperation on the Use of Peaceful Uses of Nuclear Energy' agreement.[81] Another key technical objective of Bangladesh is to get non-critical materials from India. Under the current agreement, India will provide non-nuclear material for reactors such as stone, granite, graphite, steel, or any other material usable in a reactor to slow down high velocity neutrons.[82] Similarly, under the agreement on "Exchange of Technical Cooperation and Cooperation in the Regulation of Nuclear Safety and Radiation Protection", India is committed to provide information on radiation protection, spent fuel, waste management, and training of personnel on radiation control program and administration of cooperation on rights and obligations.[83]

Having a trilateral agreement with both Russia and India in addition to separate bilateral agreements bolsters Bangladesh's quest for technical support along with assistance for human resource development. As per Chapter III, Article 3.1 (4) of the Indo-Russia's 'Strategic Vision for Strengthening Cooperation for Peaceful Uses of Atomic Energy 2014', "India and Russia will explore opportunities for sourcing materials, equipment, and services from Indian industry for the construction of the Russian-designed NPPs in third countries".[84] Likewise, the Strategic Vision's Chapter IV, Article 4(1) says, "India and Russia will consider collaboration in the development of human resources in their countries as well as in third countries through advanced training in all aspects of civil nuclear sector".[85] Bangladesh wants both types of assistance under Russia's leadership which seems to have influenced the government to ink trilateral cooperation with Russia and India. According to

[80] World Nuclear Association, op. cit.
[81] See Article 5: "Peaceful Use", Agreement between the Government of the Republic of India and the Government of the People's Republic of Bangladesh on Cooperation in the Peaceful Uses of Nuclear Energy, p 5.
[82] See Article 1(i): "Definitions", Agreement between the Government of the Republic of India and the Government of the People's Republic of Bangladesh on Cooperation in the Peaceful Uses of Nuclear Energy, p 3.
[83] See Article 2: "Purpose", Arrangement between the Atomic Energy Regulatory Board (AERB) of the Republic of India and the Bangladesh Atomic Energy Regulatory Authority (BAERA) of the People's Republic of Bangladesh, p 2.
[84] See "Strategic Vision for Strengthening Cooperation in Peaceful Uses of Atomic Energy between the Republic of India and the Russian Federation", Ministry of External Affairs, Government of the Republic of India, 2014.
[85] Ibid.

a chemical energy expert, "Bangladesh wants Russia to perform an oversight role in selection of technical assistance as well as for the smooth functioning of the project. While Russia as a primary technology supplier undertakes to build the NPPs in Rooppur, India will join as a sub-contractor, sharing its source materials and expertise in training personnel for the project."[86] Additionally, a veteran energy expert claims, "Since Russia is the reactor technology supplier for both Bangladesh and India, under the trilateral agreement, Russia can guide India's selection of proper non-nuclear materials, technical support, and skill development programs for Bangladeshi nuclear workforce which will facilitate the project's work."[87]

5.3 *Economic Logic*

The cost effectiveness and timely completion of the Rooppur project underpins the economic logic of Bangladesh for choosing a trilateral model. In constructing NPPs in any country, multinational cooperation can ensure proper utilization of investment money, plant's competitiveness, timely completion, and sustainable operation. Russia will bear 90 per cent of total investment costs of the Rooppur project (US$14 billion) which is to be repaid within 28 years with 1.75 per cent interest rate plus Libor, capped at 4 per cent with another 10 years' grace period.[88] The construction duration of the Rooppur project is set for six years from the concrete pouring date and the economic lifetime is 60 years if there is no extension, and then another 10-year is to be required for decommissioning.

Issues regarding faulty designs and technical difficulties might arise within this lengthy time frame, which may create problems and delay the project, leading to a huge economic loss for Bangladesh. Cost escalation mostly occurs over initial estimates due to construction delays, regulatory uncertainty, and politico-economic influence.[89] There are several examples that constructions of modern reactors are either abandoned or delayed due to cost overruns. The Olkiluoto-3 plant in Finland, originally thought to have considered a creative financing model, has suffered from both cost overruns and construction delays.[90] Hence, under Russia's leadership, Bangladesh wants India to play the role of a second checker for the successful completion of the project within a specific timeline. Indicating the delay of Russian-funded Iran's Bushehr power plants, a notable energy expert claims, "Bangladesh

[86] BUET Interviewee – 3, 2019.
[87] BUET Interviewee – 4, 2019.
[88] Ibid.
[89] Nathan E. Hultman, Jonathan G. Koomey and Daniel M. Kammen, "What History Can Teach Us about the Future Costs of U.S. Nuclear Power", Environmental Science & Technology, Vol. 41, No. 7, 2007, pp. 2088-2093.
[90] IAEA, *Economic Assessment of the Long-Term Operation of Nuclear Power Plants: Approaches and Experience*, No. NP-T-3.25, Vienna: International Atomic Energy Agency, 2018.

wants nothing as such and seeks timely completion of the Rooppur project with the assistance of both countries to avoid financial risk. Bangladesh seeks to assure this under the trilateral agreement".[91]

Having Russia as the main reactor vendor and India as the supplier of non-critical materials and facilitator of skill development for Bangladesh's Rooppur NPP, under the trilateral agreement, Russia will play a supervisory role for both Bangladesh and India. A veteran nuclear energy expert opines that, "The tripartite agreement will place Russia at the top, and India and Bangladesh under its leadership. Then it is likely that parties will act seriously, and the project will go smoother and faster, thus saves cost for all parties."[92] Also, under the trilateral agreement, India's supply of non-critical materials, skill development training, and consultancy services to Bangladesh's Rooppur project will be determined by Russia. In the process, Bangladesh expects to receive optimal assistance from both partners to succeed in the project timely and cost effectively. A notable energy analyst asserts, "The trilateral agreement ensures that India will appropriately transfer technical services to Bangladesh based on Indo-Russian Strategic Vision framework and Russia's guidance. Thus, the pact creates a win-win economic situation amongst Bangladesh, India, and Russia due to the optimized sharing of resources, expert services, and manufacturing of non-nuclear equipment".[93]

6. Conclusion

The study finds that all three logics i.e., politico-strategic, technological, and economic, have worked behind Bangladesh's decision to forge a trilateral nuclear cooperation arrangement with Russia and India. While it has not been possible to understand whether any of the three logics has been prioritized more than others for the trilateral model, our research observes a primacy for all three logics due to the existence of complex nature of NPP development. Therefore, we conclude that a convergence of politico-strategic, technological, and economic logic has underpinned Bangladesh's decision to choose a trilateral nuclear cooperation model. Nevertheless, the long-lasting outcome will depend on firm trustworthiness, and nuclear leadership attitude to partners.

The study has also found a few avenues of future investigation which have not been covered by the current cooperation frameworks. First, Bangladesh has no experience in handling intermediate and high level of wastes that will generate from the Rooppur NPP. Though the Bangladesh Cabinet approved the National Policy on

[91] BUET Interviewee – 1, 2019.
[92] BUET Interviewee – 3, 2019.
[93] Petrobangla Interviewee – 1, 2019.

Radioactive Waste and Spent Nuclear Fuel Management in 2019, the radioactive waste management company and disposal site are yet to be established. Although Russia is committed to take back high-level spent fuel, India can also assist in managing different levels of wastes as it has substantial expertise and vast landmass to manage waste properly. However, India's cooperation does not cover the waste-management plan, which, if covered, could have reduced a significant amount of cost in transferring spent fuel to Russia. Furthermore, since Bangladesh has plan for constructing NPPs in future, it needs to think about fuel leasing policy for running her nuclear reactors without depending solely on Russia.

Second, under the BAER Act-2012, the operators are responsible for paying compensation to the victims of nuclear accidents as per the provisions of Civil Liability for Nuclear Damage. Although the BAER Act covers limited compensation, it does not cover compensation for trans-boundary damage. Since the location of Rooppur NPP is in proximity to India, any nuclear accidents will not only affect Bangladesh but also India. Thus, it must be clear in the tripartite nuclear cooperation model that how the vendor country, the non-critical components supplier country, and the owner country will pay in case of any severe nuclear accident. The study recommends that all countries need to be a party of the 'Vienna Convention on Civil Liability for Nuclear Damage' (1997) and the 'Convention on Supplementary Compensation for Nuclear Damage' (1997). Bangladesh is not a signatory of either of the two Conventions till today. Although India has adopted both conventions, Russia has only adopted the 'Vienna convention on Civil Liability' in 1999.[94] The study insists on the requirement to establish the global nuclear liability regime for protection of the people and environment, as trans-boundary nuclear accidents such as the Chernobyl (1968) and the Fukushima (2011) may occur.[95]

Third, although the BAERA has been advancing in terms of capacity building and manpower development, it needs to further develop regulatory guides, standards, and codes with the help of the regulatory bodies of India and Russia. In this connection, Bangladesh can seek other regulatory body's assistance such as Finland's Radiation and Nuclear Safety Regulatory Authority. Similarly, it would have been the best practice if the BAERA had been under a different administrative ministry for its true autonomy. BAERA somehow compromises its independence in decision-making as NEPIO, owner, and operator, are under the same ministry - MOST. Much needs to be done in this area on an urgent basis as the two reactors are

[94] Alexey Ferapontov, "Legal and Regulatory Framework in the Field of Atomic Energy Use as a Key Element of Safety Regulation", Paper presented at the Federal Environmental, Industrial and Nuclear Supervision Service of Russia (Rostechnadzor), 1st NNR Nuclear Regulatory Information Conference, Pretoria, Republic of South Africa, 5-6 October 2016.

[95] Ben McRae, "Entry into Force of the Convention on Supplementary Compensation for Nuclear damage: Opening the Umbrella", Nuclear Law Bulletin, No. 95 (NEA No. 7252), 2015, pp. 7-25.

supposed to be operational by 2024. Otherwise, there might have commissioning and licensing delay of the reactors from the stipulated time due to lack of regulatory oversight. If regulatory processes go faster without knowledgeable and pragmatic decision in every stage from design, construction, commissioning, and operation licensing, it might push Bangladesh to the brink of unexpected events.

The study also recommends extensive collaborative research on fuel cycle development, waste management technology, waste disposal options, and development of advanced reactor technologies under the current three nations nuclear cooperation model.