The Trust Machine:
Blockchain Technology in Nuclear Security and Prospects for Application in the Middle East

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“A single source of truth.” In a region where endemic mistrust among its neighbors has been a contributor to the lack of sustainable cooperative security, the Middle East region would be a prime beneficiary of any such construct – but does it exist? According to the core tenets of the emerging Blockchain technology, this is exactly what it does, which is to create a system with inherently transparent, verifiable, and tamper-proof mechanisms. As a digital network of information that can streamline and secure data absent the presence of any central authority, Blockchain, referred to as “the trust machine,” is a manifestation of decentralized Distributed Ledger Technology (DLT) most notably associated with the cryptocurrency Bitcoin. The World Economic Forum estimates that 10% of GDP could be stored in Blockchains by 2027 (WEF, 2015), and the technology has been credited with the purported ability to revolutionize industries as wide-ranging as banking, government, and healthcare.

In recognition of the potential role that can be played by Blockchain and other emerging technologies, the IAEA has started to explore how it can be applied to the nuclear field, most notably by introducing sessions on Blockchain in its Symposium on International Safeguards (IAEA, 2018). The still limited research on Blockchain’s role in the nonproliferation and security sphere has mostly focused on possible applications in areas such as safeguards and export control, but its implications for the nuclear security domain remain largely underexplored. In the 2018-2021 Nuclear Security Plan, the IAEA highlighted emphasis by its Member States to stay abreast of evolving challenges and threats to nuclear security using scientific and technological innovation (IAEA, 2017); this is likely to continue being emphasized in future iterations of the Plan, thereby warranting greater consideration from the Agency and its Member States today. In the context of the Middle East, any contemplation as to its suitability and application needs to be prefaced by an assessment of the current state of regional nuclear security.

Nuclear security in the Middle East consists of a fragmented framework of legally binding instruments, cooperation agreements, and voluntary commitments, with significant variances in the degree of implementation between countries. While this is not too dissimilar from the global state of nuclear security, the situation in the Middle East is far more acute given the turmoil and instability being experienced across the region. The presence of non-state actors, and the “nuclear renaissance” which set off the interest of six countries in nuclear power programs, further

compound the already multi-faceted challenges to nuclear security. The measures that will be required to ensure robust nuclear security for these programs and the corresponding fuel cycle activities will need to take into account physical protection, operational security elements such as the human factor, and nuclear material accounting and control. It is the last of these that could be a candidate for the deployment of Blockchain technology, particularly in the context of the security of materials in the nuclear fuel cycle.

IAEA safeguards, which only apply to the back-end of the nuclear fuel cycle, do not include activities such as the mining, milling, or conversion of natural uranium (Vestergaard, 2015). While Uranium Ore Concentrate (UOC) is generally not considered a highly attractive option for theft or diversion due to the large quantities required to cause any significant impact, there have nonetheless been an estimated 91 incidents of illegal trafficking of natural uranium between 1993 and 2007 (Ruflo and Gregoric, 2008). Even though most nuclear industries have developed control systems for material inventory, and the majority of states maintain databases of their nuclear material stock, these processes lack sufficient oversight, are largely fragmented, and continue to operate in silos (Bal, 2018); more significant, however, is that industries can take up to 30 days to detect the loss or theft of a single UOC drum (Vestergaard, 2015).

In this context, the implementation of a Blockchain-based monitoring system could help secure the material with digital identifiers that provide real-time monitoring and tracking data to relevant parties including supplier and importer states, private companies, and any auditing or regulatory authorities (Bal, 2018). The most remarkable advantage of Blockchain in such a system, which cannot be supplanted by mere digitization, would be the creation of a secure network that is not susceptible to interference or the questioning of the veracity of its contents. This would be invaluable in furthering trust and building confidence regarding material security within a country's borders, between countries across the region, and between the region and the international community at large.

With a number of regional states currently hinging on prospects for commercially viable uranium reserves in their territories to either fuel their own plants or even contribute to a regional enrichment facility (Nasr, Ahmad, 2019), the deployment of Blockchain could also help the region

build confidence with a sometimes skeptical international community, and at the same contribute to regional security through its promotion of transparency and assurances of security. By positioning nuclear security as the lowest common denominator upon which neighboring states can find cooperation to be mutually constructive, broader regional security can in turn be enhanced. In fact, nuclear security on the global level has been relatively successful in encouraging discourse and collaboration among technical experts, and there is hope that these successes can have spillover effects into the more politically-fraught areas of nonproliferation and disarmament (VCDNP, 2018).

Ultimately, technical innovations can be critical to sustaining and strengthening efforts on nuclear security, but the fundamentals of nuclear security should continue to be promoted across the region through different methods, including capacity-building. Regional civil society organizations in particular can play an important role toward this end, and as local "trust machines," they can provide a neutral and apolitical platform for regional countries to address the transnational nature of, and challenges to, nuclear security. Given the novelty and yet to be proven concept of Blockchain in this domain, obstacles to implementation are likely to be as paramount as any possible benefits. Nonetheless, Blockchain has the potential to redefine trust and confidence-building in the era of the Fourth Industrial Revolution. The fact that it may be a long time before the adoption of any such technology should not deter further consideration – on the contrary, stakeholders advocating for or working in nuclear security should continuously seek new and innovative methods that complement and strengthen the current nuclear security regime.

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