

‘Understanding Clandestine Nuclear Procurement Networks’
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It is an honour to be invited to address the IAEA Scientific Forum, and I congratulate the organizers for putting together an impressive programme. Speaking after two distinguished ambassadors and before a respected governor, I have to ask if I am in the right league. But I have one advantage in that I represent no country and can therefore speak frankly and even undiplomatically.

In addressing the subject of, ‘Understanding Clandestine Nuclear Procurement Networks,’ I will draw heavily on a report my institute, the IISS, published in May: ‘Nuclear Black Markets: Pakistan, A.Q. Khan and the rise of proliferation networks’, for which I was the editor.

Our report defines ‘nuclear black market’ to mean the trade in nuclear-related technologies, components or material that is pursued for non-peaceful purposes and most often by secretive means. Often the trade is not explicitly illegal, but exploits loopholes in national export regulations. ‘Black’, in this case, often means shades of grey.

Global problem

At least a dozen countries have sought clandestine procurement of nuclear technology. In addition to Pakistan, our report summarizes some of the black market procurement attempts by Iraq, Iran, North Korea, Libya, Israel, India, South Africa, Brazil, Argentina, Egypt, and Syria (although in Syria’s case we do not claim that it was pursuing a weapons program). In fact, every country that has developed nuclear weapons has done so with a key assist from technology obtained elsewhere.

The transnational proliferation networks we assessed were a shifting mix of both public and private actors. Until A.Q. Khan started procuring for his own purposes, the black market suppliers were generally private merchants and the recipients were state actors. Whereas state-to-state proliferation is generally a hierarchically structured enterprise, Khan’s network is best described as a loosely interconnected set of nodes of suppliers and intermediaries in various countries. It evolved over time from a state-controlled to

a largely private criminal enterprise. At least 30 foreign companies and middlemen did deals with Khan.

Some of them also acted as intermediaries and 'sub-hubs' for his enterprise. Some acted independently, engaging in both legitimate and illicit enterprises. Some of the intermediaries also initiated deals on their own, not necessarily at Khan's instigation. Several of the European firms who supplied Pakistan's nuclear weapons program also supplied Iraq. And certain firms and individuals in South Africa supplied both Pakistan and India, wittingly or unwittingly

Khan himself cannot be characterised strictly as either a government representative or a businessman acting independently. He was both, in varying degrees according to the circumstances. Pakistan's complicity in his proliferation ranged along a spectrum. At one end, Khan's procurement for Pakistan's nuclear programme was state authorised, supported and funded, although he had great autonomy in making his own purchases. At the other end of the spectrum, the Khan network's sales to Libya were almost exclusively private business transactions beyond state control. A 1990 offer to provide Iraq with enrichment technology and project designs for a nuclear bomb also appears to have been a private venture by the network, although the lack of evidence makes it hard to draw conclusions.

It is hard to separate Khan the individual from the global network he led. He was the deal-maker, but often the network appeared to act autonomously, driven as much by Khan's foreign business partners.

By the time of the Libya deal, the network was a 'globalized supply chain'. Libya contracted Khan to manufacture centrifuge components, to assemble them offsite, and then to install and operate them at a location outside Tripoli. The vast size and scope of the order broke new ground for the network, requiring Khan to transform his organisation and its business practices to provide full service as a completely private sector entity. The Libyan case also reveals how sophisticated the network had become. The manner in which the business was conducted would have maximised profits for the network and kept the Libyan programme dependent on Khan for advice for many years into the future.

Tricks of the trade:

Iraq's extensive procurement network prospered thanks to a combination of the ineffective enforcement of already weak export controls, particularly those concerning dual-use goods; the greed and naivety of numerous businessmen and scientists; and an

elaborate infrastructure of deception involving front companies, indirect delivery routes and coordinated purchasing patterns, all designed to confound easy discovery of the true purpose of the procurements. Iran has relied on similar methods of black market procurement. Yet Khan probably perfected the methods better than anyone. Without going into the detail that would provide a kind of cook-book for future proliferators, it is useful for those trying to stop proliferation to know the techniques that Khan and others perfected. Our dossier describes 15 kinds of recipes or tricks of the trade:

1. *Clandestine diplomacy.* Until at least the late 1990s, Pakistani embassies, in particular in Europe, were key components of the Khan procurement network, and used diplomatic pouches to send material home. In Iraq's case, lists of equipment required by the nuclear programme were transmitted in Iraqi diplomatic bags. Intelligence officers and officials, such as a commercial attaché in Bonn, assisted Iraqi-controlled European companies in their negotiations and suggested which suppliers might be more creative in their product descriptions, so that they might obtain export licenses. The Iraqi security services were used to transfer funds to suppliers or middlemen.
2. *Paying above-market premium.* Direct contracts with Western industrialists were made easier because the procurement agents often paid up to 50% more than the market price.
3. *Keeping one step ahead of export controls.* When export controls began to be applied to plutonium reprocessing, Pakistan shifted to HEU production. When export controls were reinforced in the late 1970s, Pakistan purchased individual components rather than entire units, and developed industrial facilities to manufacture as many parts as possible. Pakistan also sought to import 'pre-forms' (unfinished products), which are not necessarily covered by export controls. British engineer and businessman Peter Griffin, who was a regular supplier to Khan for 25 years, boasts that his shipments conformed to whatever export controls were in place at the time.
4. *Hiding a critical component in a long list of useless material.* This 'needle in a haystack' tactic, designed to overwhelm Western export controls, was also used later by A.Q. Khan for exports from Pakistan.
5. *Buying a sample and the means to reproduce it.* For instance, in 1981–82 Pakistan tried to buy both metal components for nuclear weapons and equipment (such as precision lathes) used to make them from European companies. Once export

controls became more stringent, Pakistan did its best to become self-reliant. The Iraqis also realised that it was often easier to procure the subcomponents and equipment to construct major components themselves than to obtain tightly controlled units on suppliers' trigger lists. Iraq was skilful at accumulating multiple components from different suppliers and integrating them into a more sophisticated system. This allowed Iraq to exploit loopholes in export controls. Dual-use subcomponents carried far less risk of discovery, and it was easier to obtain a false export licence for them. For example, computer-numerically controlled machine tools, which could not be legally exported from the US when they were combined with laser alignment systems, were delivered to Western Europe or Iraq, only to be conjoined with these laser systems when they had reached their destination.

6. *Using multiple connections and buyers to look for a given item.* To ensure that at least one sale came through, Pakistan, Iraq and Iran often sent two and even three procurement agents or front companies to buy the same product. Iraq also often placed numerous orders for a desired item; each individual order would be smaller than the quantity that would trigger export controls. It calculated, usually correctly, that even if one of these orders were prohibited, there would not be a determined investigation by Western states that would uncover the other procurement channels for the same item.
7. *Using front companies.* To obtain sensitive items without openly violating export controls, and to prevent the true destination and purpose of nuclear imports from becoming generally known, Iraq established front companies both in Iraq and across Europe to act as false end users. Many of the companies that supplied Iraq with nuclear-related goods were also involved in procurement of other unconventional weapons. Some of the front companies and middlemen that Iran has used to procure nuclear-related components also seek technology relevant to conventional weapons and ballistic missiles.
8. *Falsifying the end user.* To evade national export controls and internal procedures established by manufacturing companies, the Khan network systematically falsified end-user certificates and forged order forms. Court documents detail how two South African-based members of the network forged order forms for flow meters and other special equipment from Germany for Pakistan's gas centrifuge enrichment plants. They changed the equipment listed on earlier legitimate orders from an innocent company in South Africa. Upon arrival in South Africa, the equipment was exported to Dubai for onward shipping. The Iraqis also went to great lengths, using traditional 'tradecraft', to disguise their procurement. Examples include removing names of suppliers and banking transfer agents from invoices; removing names and

destinations from wooden shipping crates; and the use of false identities by scientists when they travelled abroad.

9. *Using multiple intermediaries and transshipment points, to obscure the end user.* Alfred Hempel, a German 'nuclear entrepreneur' who died in 1989, organised illicit imports from China, Norway and the USSR for India's nuclear program in the 1980s. His methods included transporting his product through multiple states in an attempt to conceal its true customer. For example, in 1983 he diverted around 15 tonnes of Norwegian heavy water, originally intended for West Germany, via Switzerland and Dubai, finally arriving in India. He also established front companies as far afield as Liberia to conceal the origin of his shipments. Hempel often sent heavy water in consignments of just under 1,000kg, the cut-off for when notification was required for transfers below 1,000kg to non-NPT states. Another black marketer, Asher Karni, who worked as a middleman for Pakistan also sought to procure nuclear-related components for India from the United States, by claiming that South Africa was their destination.
10. *Enlisting the help of friendly countries.* Libya directly helped Pakistan by playing the role of an intermediary for uranium from Niger, and procuring on its behalf. North Korea was reportedly a conduit for some of China's assistance for Pakistan's ballistic missiles. Some reports suggest that British officials and a Norwegian firm were complicit in the illicit transfer of heavy water to Israel at the beginning of its nuclear weapons program.
11. *Setting up special financial arrangements.* To finance many of its black market sales, Iraq established a special relationship with a US branch of an Italian bank, which provided Iraq with credit on extremely favourable terms. The bank provided letters of credit to the Western suppliers of Iraq's nuclear programme and other military projects. The financial arrangements North Korea put in place to facilitate smuggling of counterfeit bank notes, drugs and other contraband goods were also likely used in the procurement of nuclear components.
12. *Involving countrymen living overseas.* Through financial or ideological incentives, Pakistan enlisted the contribution of foreign nationals of Pakistani origin. A.Q. Khan made extensive use of this method, asking several of his countrymen to collect information, or assist with the procurement of spare parts. Iran's procurement efforts have no doubt benefited from its close proximity to the United Arab Emirates, a common destination for illicit items and eventually the hub of the Khan network. Iran has been the largest recipient of the UAE's non-oil re-exports, and a quarter of the UAE's population is of Iranian origin. Iranian officials have expressed

confidence that sanctions or strengthened export controls would not prevent the progress of its nuclear programme because, as one said, 'you can get anything you need from Dubai'. North Korea attempted to obtain frequency converters from a firm in Japan, Meishin, which was affiliated with the pro-DPRK 'General Association of Korean Residents,' (Chosen Soren).

13. *Making extensive use of personal connections.* It is here that A.Q. Khan made possibly his most significant contribution. After returning to Pakistan, he wrote to several former colleagues to get specific technical information and he continued to expand his personal network of accomplices. Key associates of his included long-time acquaintances.
14. *Purchasing foreign companies:* The Iraqis invested heavily in or partly purchased European companies which then directly produced components or machinery required for the nuclear programme. One example was Matrix Churchill in the UK. Another was Al-Arabi's secret purchase in 1987 of 50% of the German firm H+H Metalform, which specialised in the production of vertical flow-forming machines. Like Iraq, Iran has explored the possibility of purchasing foreign companies to potentially serve its procurement needs. Reports from the 1990s indicate that Iranian nationals attempted to purchase small German firms to circumvent German export controls.
15. *Enlisting Foreign expertise:* Brazil reportedly pursued a nuclear weapons development program with the help of some of the German scientists and firms that aided the Iraqi programme. These engineers included ex-MAN Technologie employees Karl-Heinz Schaab, Bruno Stemmler and Walter Busse. In the early 1980s, South Africa secretly hired around 25 American reactor operators and technicians to work at the Koeberg nuclear power plant without the required US government authorisation. It might be mentioned that even the United States relied upon foreign expertise in the development of the Manhattan Project.

Assessing the damage

The Khan network was not a nuclear weapons 'Wal-Mart', since its contributions to proliferation concerned only – so far as is known today – centrifuge technology and, in one instance at least, a weapon design. However, Khan's nuclear sales had other deleterious results. The transfer of enrichment technology to North Korea precipitated the breakdown of the US–North Korea Agreed Framework and Pyongyang's resumption of its plutonium programme and weapons test, with as-yet unknown ripple effects. Khan's nuclear assistance to Iran led to a further breakdown in the global non-

proliferation regime and an international crisis over a budding uranium enrichment capability that many fear could escalate to armed conflict. If Col. Gadhafi had not decided to give up his nuclear weapons program in 2003, Libya could possibly be in possession of an atomic bomb by now, a development that would probably have set one or more of its neighbours on a similar path. By freely selling enrichment equipment and by putting the designs on computer disks, Khan significantly lowered the technical barriers to nuclear weapons development.

Various governments and international bodies have taken additional steps to stop proliferation involving non-state actors. Based on the work of British and American intelligence agencies, President Bush announced on 11 February 2004 that the Khan network had been rolled up. Indeed, although only a few of the some 40 individuals publicly identified as having worked with Khan are in prison, investigators express confidence that none remain involved in the proliferation business. Investigators are less certain, however, about the more shadowy recesses of the network. At least some of Khan's associates appear to have escaped law-enforcement attention and could, after a period of lying low, resume their black market business. Decapitating the nodes of non-hierarchical networks does not necessarily eradicate the enterprise.

Today's black market suppliers are far less integrated than Khan's "one-stop shopping." His enterprise was unique in its ability to provide nearly the entire array of materials and services required to produce highly enriched uranium. The supply side of the post-Khan market is largely comprised of individuals selling selected dual-use goods. In seeking to pre-empt proliferation trends of the future, however, concerned governments should anticipate new ways in which black market suppliers may integrate their services. Future proliferation efforts may take on various forms of quasi-state involvement, expanding in new ways the manner in which Khan's actions blurred the lines distinguishing private criminality from state-authorized activity. Future nuclear black market sources could conceivably emerge, for example, from criminal networks such as those operating in the former Soviet Union, from corruption in the governing apparatus of failing states, from jihad sympathizers and/or from elements of government organizations in states going through revolutionary changes.

International reform efforts

The international framework of export controls still contains serious gaps that could be exploited by proliferators. Firstly, many countries still lack laws and regulations governing trade in nuclear-related goods and technologies. Secondly, an even larger number of countries have yet to implement controls. Thirdly, only a handful of

countries are actually enforcing controls with thorough investigations and strict penalties. As a result, exporters of dual-use items may calculate that the risk of being caught for exporting controlled goods without a licence is minimal.

To stop nuclear black markets, governments should consider taking steps in four areas:

1. *Tighten export controls*, including by rigorously implementing UNSC 1540, which for the first time imposed a universal requirement for states to adopt and implement export controls. It is regrettable, however, that Resolution 1540 made no attempt to establish universal standards or to promote best practices. The IAEA could help establish some minimum standards in nuclear export controls by recommending, for example, adoption of the Zangger Committee's trigger list. The safeguards-strengthening Additional Protocol should also be universal.
2. *Block the supply of nuclear materials*, including by ceasing production of HEU and separated plutonium, as recommended by the Carnegie report on Universal Compliance by Joe Cirincione and his fellow authors.
3. *Enhance information collection and sharing*, including through outreach programs to industries on the front lines of receiving inquiries from would-be proliferators. Government intelligence collection is not the only source of tip-offs of clandestine nuclear procurement attempts. The IAEA's outreach programme to select industries involved in sensitive dual-use products is a promising way of acquiring information voluntarily from those most likely to come across it first. If the initial results fulfil that promise, the IAEA should consider expanding the industry outreach programme to all countries with firms likely to be approached by front companies acting on behalf of proliferators. Some governments are reluctant to allow the IAEA to establish such relationships with their industries because the IAEA, on grounds of confidentiality, does not in turn share derogatory information that would aid the governments' export licence decisions. The IAEA should consider ways of coordinating with government agencies that have their own industry outreach programmes, to help each other better assess potential proliferation problems. Other recommendations in the area of information sharing include the need for members of the Nuclear Suppliers Group to share export approvals and denials with the IAEA. The Director-General on his own authority can ask member states to provide information on both the export and import of specified equipment and materials.
4. *When all else fails, interdiction efforts*. The US-led Proliferation Security Initiative is an important complement to other nonproliferation tools, and not a substitute for them.

These steps will not quell the demand for nuclear weapons. That would require fundamental changes to the international system and to the role accorded nuclear deterrence. In most markets, when there is a determined demand and the price is high enough, there is likely to be a supply. Supply-side controls can minimize illicit exports, however, by raising the costs and risks to the point where most suppliers will not find it worthwhile. Strict constraints on the black market are essential to prevent the breakdown of the non-proliferation regime.