

A.Q. Khan and the limits of the non-proliferation regime

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From around 1987 to 2003, Dr Abdul Qadeer Khan was moonlighting. During the day, he was the venerated head of Khan Research Laboratories (KRL) and self-styled 'father' of the Pakistani nuclear bomb. At night, he was dispensing nuclear technology and information to both Pakistan's friends and enemies. For these sixteen years, Khan—as either sanctioned head of KRL or unsanctioned head of an illegal proliferation network—ticked his way down the list of states of proliferation concern, making contact with Iran, Iraq, North Korea, Libya, Syria and Saudi Arabia.

The present nuclear non-proliferation regime was crafted during a different time for different threats. Today, the Cold War-era treaties, laws, export controls and norms have to function in a global economy, which hosts increasingly powerful non-state actors, and with a slowly growing number of states who are either opting out of or internally subverting the Nuclear Non-Proliferation Treaty (NPT). The A.Q. Khan proliferation network skirted on the edges of commerce, avoided the tangles of national and international law, and developed an impressive list of suppliers and clientele.

The international community is not just the passive recipient of the present structure of nuclear constraints. Concurrent with revelations about the size, scope and scale of the A.Q. Khan network, the international community—with urgent American prodding—has sought to reform certain aspects of the status quo. Not all of these changes were targeted to prevent the next A.Q. Khan, but many of them are relevant to that task. This essay begins by analysing how the Khan network functioned, where it was located, and who were its members. Then the essay will examine the subsequent American and international policy responses, their relevance and their potential for success.

A televised confession

Reports of Pakistani complicity in illicit technology transfer had been floating around Western capitals since the late 1990s.¹ But besides rumours and the periodic demarche, the Pakistani government was not provided with actionable intelligence about Khan's proliferation network. The statements of concerned Western representatives were viewed with suspicion in Islamabad.

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Why should Pakistan trust the very governments who had consistently opposed Pakistani efforts to gain a nuclear deterrent? Was this just another ploy to hamstring Pakistan's legitimate right to defend itself?

As the severity—and credibility—of the rumours began to grow in late 2002 and early 2003, it was becoming more difficult for Islamabad to ignore. Up to then, Pakistani interlocutors would argue that centrifuge technology was not the state of the art. Fifties-era centrifuge designs, pioneered by Dr Gernot Zippe, were accessible in rudimentary form through old United States Atomic Energy Commission documents. The investigation of the International Atomic Energy Agency (IAEA) into Iran had revealed data that, unlike Western intelligence, could be given to Pakistan. That data was very difficult to refute with Pakistan's normal responses. It seemed to indicate that in Iran, the enrichment programme was not some generic knockoff of the Zippe device, but rather that these were Pakistani designs, Pakistani components and, perhaps, small traces of enriched fissile material from Pakistan.

Armed with this information, the Pakistani government had to do something. In a carefully sequenced series of events, Khan was interrogated, confessed and was pardoned. Perhaps Seymour Hersh was overly harsh in calling it 'a make-believe performance in a make-believe capital'.² But even Khan's choreographed confession is indicative of the public confusion about what occurred. He stated in an address before the nation, 'The recent investigation was ordered by the government of Pakistan, consequent to the disturbing disclosures and evidence by some countries to international agencies, relating to alleged proliferation activities by certain Pakistanis and foreigners over the last two decades. The investigation has established that many of the reported activities did occur, and that these were invariably initiated at my behest.' An explanation of what the activities were, where they were conducted or why they were initiated was not given. Instead, Khan said that his 'activities', whatever they might have been, 'were based in good faith but on errors of judgment related to unauthorized proliferation activities'. This confusing sentence was muddied by the next: 'I wish to place on record that those of my subordinates who have accepted their role in the affair were acting in good faith, like me, on my instructions'. If his deputies were acting on instructions, was Khan as well? The next sentence answered, 'I also wish to clarify that there was never ever any kind of authorization for these activities by a government official.'³

The next day, President Pervez Musharraf disclosed that he had pardoned Khan for his wrongdoing. Domestically, he had to frame the issue carefully. In his decades of public service, Khan had cultivated a cadre of journalists and surrogates who would proselytize on his behalf.⁴ This metallurgist and lab director managed to become 'father of the Pakistani bomb' in the public imagination, a title that ignored the role of other prominent scientists in the Pakistani programme. The public investigation of proliferation activities had struck all the discordant notes in Pakistani politics: foreign intervention into Pakistani security affairs in collaboration with a military government. Musharraf's opponents were using the Khan affair to challenge the military ruler's commitment to the nuclear programme. The alliance of religious parties had started a violent protest march in Karachi—a distressingly easy feat in the once-cosmopolitan city.⁵ The Alliance for the Restoration of Democracy, an umbrella group of opposition parties, was planning to launch a 'Remove Musharraf and Save the Country' movement.⁶ And while neither effort threatened the stability of the Musharraf government, the need for careful political manoeuvring was apparent.

Musharraf was emphatic in his address to the gathering of domestic and foreign press: 'This country will never roll back its nuclear assets, its missile assets.' He stressed that he was not influenced by outsiders. 'Not a single foreigner was involved' in the investigation. 'There is no pressure on us ... to let him go, free him or punish him, do this or do that.' Moreover, Musharraf said he was personally hurt by the investigation. Khan 'is my hero', the general stated. 'He always was and still is, because he made Pakistan a nuclear power.' But in the end, the investigation had been clear: 'Unfortunately, all

proliferation... [took place] under the supervision or orders of Dr. A.Q. Khan. No government official, no military man is involved... . The proliferation started in the 80s and Dr. A.Q. Khan retired, roughly, around 2001 and it ended around that time.' But after meetings of the National Command Authority and the Cabinet, Musharraf decided to accept Khan's clemency petition, 'because he is our national hero.'⁷ Though Musharraf did not say so on that Thursday evening, Khan would be under virtual house arrest indefinitely and his pardon was conditional on his continued cooperation with the investigation.

The Khan network

Without diminishing the difficulties of indigenous nuclear programmes, all nuclear weapons programmes after the Manhattan Project have relied upon illegally acquired knowledge, technology or material. On the evening that Musharraf pardoned Khan, the Pakistani president was blunt: 'If all the nuclear powers of the world are reviewed from the start, all of them established themselves through the underworld. We have also acquired it [nuclear capability] through the underworld. India has also acquired it through the underworld.'⁸

In 1974, India demonstrated that guarantees of 'peaceful' and 'civilian' use were quite flexible to interpretation. Having developed a sizeable indigenous nuclear structure—at dramatically reduced costs because of the 'Atoms for Peace' programme—India was able to conduct a 'peaceful nuclear experiment'. The eight-kiloton explosion at the Pokhran test range did not comfort its next-door neighbour. Pakistan was also unlucky because the explosion forced the international community to create an enforcement structure to support the six-year-old NPT. Building on deliberations of the Zangger Committee, by the end of 1974, the United States created the Nuclear Suppliers Group (NSG) with six other countries (the Soviet Union, the United Kingdom, France, the Federal Republic of Germany, Japan and Canada).

These countries—partially because of American insistence—were extremely careful in their cooperation with Pakistan, out of a fear that it would quickly follow India's lead down the nuclear path. All of the Pakistan Atomic Energy Commission's major projects suffered disruption. Canada refused to supply nuclear fuel, heavy water or spare parts for the Karachi Nuclear Power Plant.⁹ Germany halted construction of a heavy-water production facility. And, after initially delaying, in 1978 France abandoned an agreement to build a plutonium reprocessing facility for Pakistan.

Pakistan was lucky because as the plutonium route was closed down, a uranium pathway was opening. A.Q. Khan had studied in Western Europe and, after completing his post-graduate education, worked for the Anglo-Dutch-German centrifuge enrichment partnership, Urenco. In 1974, Khan wrote President Zulfikar Ali Bhutto that he was willing to return to Pakistan. He left the firm in 1976, bringing with him stolen centrifuge designs and, crucially, a list of 100 companies that supplied centrifuge parts and high-quality materials. After returning to Pakistan, he found the nascent NSG still had difficulty enforcing its non-proliferation agenda. He later said, 'My long stay in Europe and intimate knowledge of various countries and their manufacturing firms was an asset. Within two years we had put up working prototypes of centrifuges and were going at full speed to build the facilities at Kahuta.'¹⁰ The European firms were eager to do business: 'They literally begged us to buy their equipment', Khan recalled.¹¹

The NSG was a response to state-to-state technology transfer. Khan circumvented it by creating firm-to-firm relationships. Even if these were interrupted, he could quickly reform the acquisition network. Procurement pathways could be found through Pakistani

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government offices overseas, front companies for A.Q. Khan, or middlemen who shipped through trading hubs in Malta or Dubai. During these early years in particular, the network was able to keep ahead of the supplier cartel. The omission of many key sensitive technologies helpful in centrifuge production from the NSG trigger list further increased the ability of the network to navigate around the obstacles that did exist.

The NSG was most successful at preventing large-scale projects. In practice, this meant the NSG was much better able to stop plutonium efforts, which required unsafeguarded power plants, then it

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was in stopping the myriad components necessary for a centrifuge cascade. To stop the flow of magnets, high-quality steel and countless other small and large parts, nuclear suppliers had to rely on outdated infrastructures. Ministries of industry and commerce, customs agents and immigration officials became the first line of defence. Militaries and diplomats were secondary to this endeavour.

After a decade of supplier controls, two trends were apparent. First, a growing 'community' of unprincipled suppliers, shady middlemen and corrupt financiers had developed to circumvent those controls. While these networks might have begun to carry out one country's acquisition efforts, they could be modified easily to satisfy another customer. In fact, for the 'service providers' the economies of scale that came with additional channels for trade must have been attractive. What emerged, though, is a loose collection of individuals and companies that may or may not be loyal to a government or subject to state control.

The second trend is also a result of supplier controls. The higher cost and uncertain reliability of illegally procured components increased the incentives for indigenous programmes to supply the demand. This trend had added impact when combined with the inevitable diffusion of scientific know-how. The effect was a growing cadre of nuclear scientists and a larger manufacturing base for components that previously would have only been accessible abroad.¹²

By the mid-1980s, Pakistan had acquired a nuclear-weapons capability, in spite of the supplier controls. In 1987, two events—one loud and one quiet—marked this transition. First, in an interview with an Indian journalist, Khan stated that Pakistan had the ability to produce nuclear weapons.¹³ This remark was meant to be noticed and it was. The second event had a lower profile. Khan Research Laboratories' scientists published their first papers on constructing more difficult centrifuges of maraging steel, rather than earlier aluminium-based designs. This was followed in 1991, when KRL scientists published details of how to etch special grooves into the bottom bearing of the centrifuge to incorporate lubricants.¹⁴ At this same time, Khan was apparently ordering excess spare parts. These four factors—autonomy because of successfully acquiring a nuclear deterrent, less urgency because of the same, over-ordering of parts, and technological innovation—meant that Khan had the time and resources to sell to others, if he desired. Khan reversed the flow of his network—and instead of procuring, he began proliferating.

The network functioned through transit hubs, front companies and, most ambitiously, creative off-shoring of manufacturing. Components would be purchased from mostly European firms with false end-user certificates destined to Dubai or Malta or some other trans-shipment point. There, they could be off-loaded and sent on to their true destination. This trade was not just carried out by a few firms. Just the nationalities mentioned in press accounts—American, British, Dutch, German, Israeli, South African, Swiss and Turkish, to name a few—indicate the scope of the problem. Such businesses could just be a small father-and-son outfit, they could be connected to organized crime, or they could be unscrupulous or just unsuspecting import-export firms.

The Malaysian investigation into one individual—Buhary Seyed Abu Tahir—reveals this complexity. According to the report of the Malaysian Inspector-General of Police, Tahir began working with Khan

Research Laboratories in 1985, ostensibly selling air conditioning equipment. Tahir was principally involved in establishing a factory for the production of centrifuge components in Shah Alam, Malaysia. Tahir is co-owner with his brother of the SMB Group based in Dubai. The factory he organized in Malaysia, however, was owned by SCOMI Precision Engineering (SCOPE), which is itself a subsidiary of the SCOMI Group. In Malaysia, Tahir worked closely with Peter Griffin and his son Paul, British owners of a Dubai-based company, Gulf Tech Industries. Griffin recommended that Tahir receive quality-control advice from Urs Tinner, whose father, Friedrich, is president of a Swiss firm called CETEC. Tinner and Griffin helped ensure that the factory received production equipment from the United Kingdom, France, Spain and Taiwan to make precision parts. That Malaysian factory made parts which could be used in centrifuges that were sent to Libya via a trading company in Dubai. SCOPE, the company that owned the factory, was judged by the Malaysian police to be unaware that they were even involved in nuclear proliferation. Malaysian export control officials did not suspect that a firm in the NPT-signatory country would be circumventing the treaty.¹⁵ What should be evident from this single example is that Khan's trading network was complex and multinational—with over a half-dozen companies from several different countries involved in just this one portion of the overall operation. Press accounts suggest that maybe six such workshops existed elsewhere, implying an even denser web of families, old friends and front companies. What did they all do?

A damage report

The available open sources indicate that in the last two decades A.Q. Khan almost certainly provided significant nuclear technology assistance to Iran, Libya and North Korea.¹⁶ He attempted to offer support to a pre-Persian Gulf War Iraq. He may have provided technology or information to Syria. And his contacts with Syria and some sub-Saharan African countries are at least a cause for concern. There are eight important points to draw attention to regarding Khan's transfer of nuclear technology.

First, Khan's operation began almost immediately after Pakistan had achieved a nuclear capability for itself and lasted until very recently. The most likely first customer was Iran, which began receiving foreign centrifuge assistance 'around 1987', according to the IAEA.¹⁷ In 1990, Khan appears to have contacted Iraqi intermediaries offering his services.¹⁸ Supplying nuclear technology to an antagonistic couple like Iran and Iraq might have proved very lucrative, but Saddam Hussein's government apparently rejected the proposal as a ploy by the United States. While all available evidence indicates that the Iranian relationship was maintained until the mid-1990s, the 'best guess' dates for the beginning of cooperation with North Korea and Libya are both around 1997.¹⁹ The gap in securing new customers is inexplicable from our current data.

Second, as might seem intuitive with such a diverse group of countries, there does not appear to be a single set of motivations. The commencement of nuclear cooperation with Iran could be explained by the tenure of a former Pakistan Army chief, General Aslam Beg. Beg held peculiar notions about an Iranian-Afghan-Pakistani alliance that would engage in 'strategic defiance' of the West. In his eyes, nuclear cooperation may have been a way to cement such an arrangement. If that was his objective, it was unfulfilled, as Pakistani-Iranian relations quickly soured as a result of the civil war in Afghanistan. Instead, any Pakistani nuclear technology given to Iran has now come back to haunt Pakistani strategic planners, who may one day face two nuclear neighbours. Islamic unity may explain Pakistani cooperation with other countries—though unlikely with Shi'ah Iran—but fails to explain the North Korean relationship. Strategic cooperation arrangements, which could explain the North Korean partnership, do not make sense in the context of a state like Libya, which has little to offer Pakistan in return. In fact, of the four countries (Iran, Iraq, Libya and North Korea) where credible evidence exists

of either cooperation or an offer of such cooperation, Pakistan has had historically strained relationships with three of them (Iran, Iraq and Libya).²⁰ The only common explanation for all the cases might be personal avarice on the behalf of A.Q. Khan and his associates. But even then, why would Khan want more money if the Pakistani state was happy to let him skim money from KRL coffers?

Third, the prices for this nuclear assistance were relatively affordable. The most extensive information relates to the Pakistani-Libyan relationship, where American government officials estimate that the Khan network received only US \$100 million.²¹ In comparison to the cost of conventional military armaments—for instance, the Saudis paid China US \$2 billion for between thirty-six and forty Chinese CSS-2s²²—this seems quite affordable for a strategic planner looking for asymmetric advantage.

However, the price may be correct for the incomplete product Khan seems to have sold. Of several thousand centrifuges that suppliers were supposed to provide to Libya, they had only received all of the parts for two units.²³ Iran expressed displeasure with the quality of the product they received from their foreign suppliers. As the IAEA summarized, '[Iranian] efforts had been concentrated on achieving an operating centrifuge, but many difficulties were encountered as a result of machine crashes attributed to poor quality components.'²⁴ Further, Iran's centrifuges appear not to have been a turnkey affair—Iran was still on the market for 4,000 ring magnets of specifications suitable for use in the P-2.²⁵ Of the largest three customers, perhaps only North Korea managed to create a functioning centrifuge cascade, and even that is speculative.

Fifth, there appears to be no evidence that Khan was transferring missile technology. Perhaps this is because KRL did not test the liquid-fuelled, Nodong-based Ghauri missile until April 1998, which is comparatively late in the game. Perhaps North Korea was already well established in the missiles-for-rogue-states market. Or perhaps Khan did not have the indigenous infrastructure and supplier networks to manufacture extra missile components and transport them overseas.

Sixth, over nearly two decades of proliferation activity originating in Pakistan, the only individuals that have been accused of illegal involvement have worked in Khan Research Laboratories. As Pakistani Foreign Minister Khursheed Kasuri noted:

To place matters within their proper context, we say that from 6,500 scientists who work in the nuclear programs out of 62,000 who work in nuclear and missile establishments, we investigated 11 persons, including seven scientists, one technician, and three from the security agencies. Four of these were released after the investigations proved their innocence. Yes, there were accusations against seven people. Unfortunately, one of them, Abdul-Qadeer Khan, is admired by all in Pakistan.²⁶

While this fact does not eliminate the mistakes that Pakistanis made in establishing their safety and security arrangement, it does seem to indicate that the problem was endemic to KRL, not to Pakistani nuclear stewardship more generally.

Seven, the Khan network may have left 'damaging debris' in the open domain. Libya received nuclear-weapons designs from the Khan network—supposedly as 'a bonus'—which were transferred inside of an Islamabad dry cleaner bag.²⁷ Many of the blueprints, designs, sketches and instructions found in Libya appear to have been copies of copies of copies. If the copies were passed on through middlemen, control of the information may have been irrevocably lost. In addition to such intangible transfers, Libya also is still waiting to receive centrifuge components that it ordered and paid for, but which were never delivered.²⁸ If the parts had already been manufactured, they may simply have been diverted to another customer.

Eighth, and finally, there may be more revelations to come. In addition to relationships that have been publicly reported in great detail, there are three possible relationships that, while largely unsubstantiated, are still troubling. Recent reports that Syria was operating centrifuges—when combined

with reported visits by A.Q. Khan and associates to Syria in 1997 and 1998 and meetings with Syrian officials in 2001—have led to considerable curiosity.²⁹ The visit by Saudi Arabian defence minister Prince Sultan Bin Abd al-Alziz to the Kahuta enrichment facility in May 1999 and A.Q. Khan's September 2000 visit to Riyadh have done little to assuage concerns over potential Saudi-Pakistani nuclear cooperation. Reports that Khan and his entourage took four trips to Africa, visiting Chad, Mali, Niger, Nigeria and Sudan, opened up a new continent to concern.³⁰ And while none—or all—of these reports may be true, they should indicate the incredible difficulty of discerning a visit from a business trip. Proliferation networks can be impenetrable organisms. Does the international community have a chance?

Policy responses

The above transfers have simultaneously highlighted four trends of crucial importance for international security:

- the global diffusion of knowledge, technology and engineering necessary for the production of weapons of mass destruction (WMD);
- the growing access that non-state actors have to WMD technology;
- an emerging illicit international market of WMD technology; and
- the increasing number of states with (partially) indigenous WMD research, development and production efforts, who are able to pass that knowledge to third parties.

In the United States, the Bush Administration has pursued five inter-related strategies to combat these trends. First, it hopes to reinforce the international non-proliferation regime by gaining compliance from key suppliers, most notably China and Russia, while ensuring adequate safety and security measures are taken in other WMD-possessing nations. Gaining Chinese accession to the NSG and the passage of UN Security Council resolution 1540 on weapons of mass destruction were both significant steps in this direction. Interestingly, the United States views the resolution as having broad applicability. As United States Assistant Secretary of State for Nonproliferation John S. Wolf argued, 'I would submit that the resolution also looks at state-state transactions, as well as state-nonstate transactions. There's a whole universe of state-state, state-nonstate, nonstate-nonstate, nonstate-state [transactions], and all of those need to be covered by comprehensive export controls and rigorous enforcement.'³¹

Secondly, and complementing the goal of Security Council resolution 1540, the United States hopes to work with the Group of Eight (G8) to secure and eliminate existing nuclear, chemical, biological and radiological materials. In the 2002 summit in Kananaskis, Canada, G8 leaders identified their priority concerns as 'the destruction of chemical weapons, the dismantlement of decommissioned nuclear submarines, the disposition of fissile materials and the employment of former weapons scientists,' and committed themselves 'to raise up to \$20 billion to support such projects over the next ten years.'³²

Third, the Bush Administration envisions a radical reform of the NPT, closing off enrichment and reprocessing to those states that do not already possess such capabilities and prohibiting the importation of civilian nuclear equipment by states who have not signed the Additional Protocol. However, the ability for the United States to fundamentally alter the NPT bargain seems doubtful at best.

Fourth, in a creative mix of norm- and institution-building with military force, the United States also hopes to increase the capability and the authority of the United States and like-minded countries to interdict the illegal trade of WMD technology or material. Through greater intelligence, military and law enforcement cooperation, combined with the creative application of antiquated piracy and

contraband laws, the Proliferation Security Initiative (PSI) hopes to complicate the trade in WMD technology. However, the Libya case is both a salutary and cautionary tale. After the ship *BBC China* was intercepted in Taranto, Italy in October 2003, the Libyans opted to stop pursuing their nuclear programme. Interdiction, it would seem to indicate, can be a powerful policy lever. But, even though the American-led team had precise intelligence and managed to seize five containers of proscribed materials, they apparently missed one container full of centrifuge components, which continued on to Tripoli aboard the *China*.³³ The Libyans, serious about their desire to be rid of their nuclear programme, were kind enough to report the surprise shipment to the United States, but the incident does reveal the limitations of even well-executed PSI operations.

Fifth, the United States military capability will perform a range of policy functions for the Bush Administration. Abstractly, the United States hopes to dissuade WMD aspirants from initiating acquisition efforts. While dissuasion is one of four American defence policy goals,³⁴ it remains unclear how to be so threatening that others do not respond with threatening postures of their own. If dissuasion fails, the United States hopes to enhance deterrence through the possession of overwhelming conventional superiority and the maintenance of a flexible and more usable nuclear arsenal. And finally, the United States will deny, degrade and, if necessary, destroy WMD technology possessed by dangerous states.

What should be apparent is that American strategy only tangentially deals with the threat of proliferation networks. By reducing the number of states who possess WMD, it hopes to starve networks of a source of technology and material. By securing sensitive technology and reinforcing export controls, it hopes to further reduce the supply that leaks into the non-state arena. Finally, by significantly increasing interdiction efforts, the Bush Administration seeks to decrease the profits for proliferation networks and/or increase the costs for acquiring states.

An uncertain future

In March of 1963, United States President John F. Kennedy warned that fifteen to twenty-five states could possess nuclear weapons by the 1970s.³⁵ Luckily that future has not come to pass. But the technology underlying nuclear weapons is in an increasing number of hands. More and more states have the capability to develop a nuclear arsenal, but choose not to. The A.Q. Khan proliferation network was troubling, but not disastrous. The technology provided, while significantly aiding recipient states, was nowhere close to providing a 'turnkey' nuclear programme. Though the proliferation network was outside of state control, sales of its wares apparently only went to state entities. And while Pakistan's nuclear stewardship has been deeply questioned, the confinement of these activities to just one of Pakistan's labs is a cause for hope.

The Bush Administration's agenda for dealing with proliferation seems unlikely to advance far. The United States is simultaneously seeking to reinforce its deterrence through military strength, trying to maintain its room for manoeuvre by avoiding international commitments, and hoping that others subscribe to new rules and responsibilities. Having invested enormous political capital in an ultimately flawed counter-proliferation campaign in Iraq and still pursuing a diplomatic exit from negotiations with North Korea, it seems unlikely that American diplomats will also be able to assuage the concerns of the international community about its package to reduce the WMD threat. For now, the international community will probably have to be content with the slow and measured progress of the IAEA investigation in Iran, the British and American investigation in Libya, and the Pakistani domestic investigation of A.Q. Khan.

Notes

1. The Butler Commission summarizes the state of British knowledge: 'During the 1990s, there were intermittent clues from intelligence that A.Q. Khan was discussing the sale of nuclear technology to countries of concern. By early 2000, intelligence revealed that these were not isolated incidents. It became clear that Khan was at the center of an international proliferation network.' See United Kingdom, 2004, 'Review of Intelligence on Weapons of Mass Destruction', Report of a Committee of Privy Counsellors, 14 July, p. 18, at < www.official-documents.co.uk/document/deps/hc/hc898/898.pdf>.
2. S. Hersh, 2004, 'The Deal', *The New Yorker*, 8 March.
3. Khan's statement is reprinted in full in R. Ali, 2004, 'Dr Khan Seeks Pardon', *Dawn* (Karachi), 5 February.
4. An excellent example is Z. Malik's hagiographic *Dr. A.Q. Khan and the Islamic Bomb*, Islamabad, Humat Publications, 1992.
5. 'Several Hurt in Karachi Violence', *The News* (Islamabad), 6 February 2004.
6. 'ARD Planning to Launch Remove-Musharraf Drive', *Dawn* (Karachi), 6 February 2004.
7. PTV World in Urdu, 'Musharraf Addresses News Conference on Proliferation, Pardons Khan', 5 February 2004, FBIS-SAP20040205000124.
8. *Ibid.*
9. For a detailed description of the challenges this created, see M. Ahmad Khan, 1998, 'How Pakistan Made Nuclear Fuel', *The Nation* (Lahore), 7 and 10 February, FBIS-FTS19980211000724 (posted 11 February 1998).
10. P. Edidin, 2004, 'Pakistan's Hero: Dr. Khan Got What He Wanted, and He Explains How', *New York Times*, 15 February.
11. W.J. Broad, D.E. Sanger and R. Bonner, 2004, 'A Tale of Nuclear Proliferation: How Pakistani Built His Network', *New York Times*, 12 February.
12. For an examination of how Iran has sought to develop its nuclear 'human capital', see J. Boureston and C.D. Ferguson, 2004, 'Schooling Iran's Atom Squad', *The Bulletin of the Atomic Scientists*, vol. 60, no. 3 (May-June), pp. 31-35.
13. Khan gave an interview with the Indian journalist Kuldip Nayar on 28 January 1987, in the midst of a crisis over India's 'Brasstacks' exercises. Nayar does not publish the account until 1 March, however, shopping around for an appropriate venue.
14. 'From Rogue Nuclear Programs, Web of Trails Leads to Pakistan', *New York Times*, 4 January 2004.
15. 'Press Release by Inspector-General of Policy in Relation to Investigation on the Alleged Production of Components for Libya's Uranium Enrichment Program', *The Star* (Kuala Lumpur), 21 February 2004, FBIS-SEP20040221000035.
16. These 'big three' relationships are explored in greater detail in C. Clary, 2004, 'Dr. Khan's Nuclear Walmart', *Disarmament Diplomacy*, no. 76 (March-April), pp. 31-36.
17. IAEA, 2003, 'Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran', report by the Director General to the Board of Governors, 26 August, GOV/2003/63, p. 6, < www.iaea.org/Publications/Documents/Board/2003/gov2003-63.pdf>.
18. Memo from Iraqi Mukhabarat to PC-3, 'Subject: Proposal', 6 October 1990, < www.isis-online.org/publications/southasia/khan_memo_scan.pdf>; and D. Albright and C. Hinderstein, 2004, 'Documents Indicate A.Q. Khan Offered Nuclear Weapon Designs to Iraq in 1990: Did He Approach Other Countries?', Washington, DC, Institute for Science and International Security, 4 February, < www.isis-online.org/publications/southasia/khan_memo.html>.
19. These dates are discussed in greater detail in C. Clary, *op. cit.*
20. People often refer to Libya's early support of Pakistan's nuclear programme as a potential explanation for Pakistani technology transfer. However, there are two reasons this seems implausible. First, such support occurred in the mid-to late 1970s, and beginning repayment in the late 1990s seems somewhat tardy. Second, and more importantly, after military dictator Zia ul-Haq hanged deposed Prime Minister Zulfikar Ali Bhutto in 1979, relations between Libya and Pakistan soured. Bhutto and Libyan President Moammar Gadhafi had formed a close relationship.
21. D.E. Sanger and W.J. Broad, 2004, 'Pakistani's Nuclear Earnings: \$100 Million', *New York Times*, 15 March. Despite the article stating that Khan 'netted \$100 million', the quote by administration official Jim Wilkenson seems ambiguous about whether this figure was net or gross.
22. M. Hibbs, 2003, 'Pakistan believed design data source for centrifuges to be built by Iran', *Nuclear Fuel*, 20 January.
23. D. Horner, 2004, 'Bolton: U.S. Okay with Response by Pakistan to Khan Network', *Nuclear Fuel*, 12 April, p. 11; and J. Warrick, 2004, 'Libyan Nuclear Devices Missing', *Washington Post*, 29 May.
24. *Ibid.*

25. IAEA, 2004, 'Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran', report by the Director General to the Board of Governors, 1 June, GOV/2004/34, p. 5, <www.iaea.or.at/Publications/Documents/Board/2004/gov2004-34.pdf>.
26. Interview with Pakistani Foreign Minister Khursheed Mehmood Kasuri by Jamal Rayyan from the "Today Encounter", Al-Jazeera Satellite Television Channel (Doha), 29 February 2004, FBIS- GMP20040301000119.
27. W.J. Broad, 2004, 'Libya's Crude Bomb Design Eases Western Experts' Fear', *New York Times*, 9 February.
28. J. Warrick, 2004, 'Libyan Nuclear Devices Missing', *Washington Post*, 29 May.
29. D. Frantz, 2004, 'Ring May Have Aided Syria', *Los Angeles Times*, 25 June.
30. R. Carroll, 2004, 'Pakistani Nuclear Chief's African Visits Revealed', *The Guardian* (Manchester), 20 April.
31. 'The Bush Administration's Non-proliferation Policy: An Interview with Assistant Secretary of State John S. Wolf', *Arms Control Today*, vol. 34, no. 5, June 2004.
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