The Shadow Sector: North Korea’s Information Technology Networks

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North Korea’s Information Technology Networks

By Andrea Berger, Cameron Trainer, Shea Cotton, and Catherine Dill
Executive Summary

North Korea's commercial information technology (IT) industry has operated overseas, largely unnoticed, for decades. It sells a range of products and services including website and app development, administrative and business management software, IT security software, and biometric identification software for law enforcement applications. Its global network includes a myriad of front companies, intermediaries, and foreign partnerships. Yet despite the attention currently paid to North Korea’s overseas revenue streams and its offensive activities in cyberspace, the spotlight has yet to illuminate the money-spinning North Korean IT firms whose offerings seem to have found their way into corporate supply chains and potentially even Western-allied law enforcement agencies. Drawing upon extensive open-source investigations by the authors, this paper examines several nodes in North Korea-linked IT networks and considers the implications for current and future policy efforts to stem North Korean revenue and mitigate the cyber-security threats the country poses.

Introduction

A common assumption about North Korean export activity is that, as former Secretary of Defense Robert Gates once said, the Democratic Republic of North Korea (DPRK) will “sell anything they have to anybody who has the cash to buy it.” Pyongyang’s information technology (IT) sector bears out this view. Gaining steam in the 1990s, the North Korean IT sector has expanded to include a significant network overseas in locations such as China, Russia, Southeast Asia, the Middle East, and Africa. Today, the country’s firms generate foreign revenue from the sale of a wide range of related goods and services, including website and app development, administrative and business management software, radio and mobile communications platforms, IT security software, and biometric identification software for law enforcement applications. North Koreans appear to have marketed virtual private networks (VPNs) and encryption software in Malaysia, sold fingerprint-scanning technology to large Chinese companies and parts of the Nigerian government, produced facial recognition software for law enforcement agencies via front operations, and built websites for myriad individual and corporate clients.

North Korea’s activities in the IT sector pose three main challenges for international efforts to curb threats emanating from the country. First, revenue accrued through the sale of IT goods and services likely blunts the impact of sanctions imposed by the United Nations and individual countries. Those sanctions focus primarily on the North Korean export of tangible commodities. Generally, services are considered only when they relate to military contracts, or more recently, to migrant labor. As a result, it is possible that North Korea may more actively seek to generate funds through intangible or less-tangible offerings, including those in the IT sector. Indeed, one specialist has recognized the DPRK as a source of affordable IT talent.1 Cultivating IT expertise on activities such as software development not only provides revenue for the country, but also sidesteps the need to export migrant laborers in contravention of UN sanctions.2

Moreover, some of the revenue earned through the IT sector may directly or indirectly benefit individuals or companies linked to North Korea’s nuclear and missile programs. The network of companies linked to Glocom—a company recognized by the United Nations for both its links to the UN-

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sanctioned North Korean intelligence agency and its role financing the country’s nuclear programs—
includes at least two IT companies, examined below.\(^3\)

The Korea Computer Center (KCC)—established in North Korea in 1990 to expand the country’s IT
capabilities and, according to the United States Treasury, operating overseas in Germany, China, Syria,
India, and the Middle East—is another interesting case. It was designated by the US Treasury June 1,
2017\(^4\) for generating revenue for the North Korean regime, including the UN-sanctioned Munitions
Industry Department.\(^5\) North Korea’s continued revenue generation through IT thus seems to be a
possible lifeline for at least some sanctioned entities, dulling the effect of efforts to exert particularly
pointed pressure on those parts of the North Korean system.

It is possible that North Korea’s IT sector may yet become a more focused target of the “maximum
pressure” campaign championed by the United States. Though IT exports writ large have yet to be
subject to international sanctions, President of the United States Donald J. Trump signed, in September
2017, Executive Order 13810, which specifically includes North Korea’s IT sector under the new
sanctions authority.\(^6\) Taken together with the sanctions on KCC in 2017, this indicates that the US
Treasury may be paying greater attention to North Korean IT activities. Given Washington’s leading role
in designing sanctions at the UN level, this interest could translate into multilateral measures in future
as well. Focus of that kind would help raise attention to North Korean activity in the sector and provide
a relatively straightforward basis for countries interested in taking action to curb it.

Restricting North Korea’s activity in the IT sector will nevertheless involve a second challenge. Less tangible
technology transfers of the kind sold by North Korea are intrinsically difficult for countries to detect and
prevent, but they present an even greater problem when layered with North Korea’s evasive practices.
North Korean networks active overseas have become increasingly adept at “hiding in plain sight” and
concealing visible links to Pyongyang. Front companies and aliases help North Korean firms blend into
the Asian marketplace, allowing them to market their goods as being from China or Southeast Asia, for
example. This approach means North Korean individuals and entities can often convince unwitting clients
to use them as a supplier without raising any alarm bells that something is amiss. This applies to the IT
sector as well. Investigations indicate that North Korea may be using freelancing websites—such as
Freelancer.com and Guru.com—to further enhance their anonymity and generate new business from
customers unaware that their business is going to Pyongyang.

Third, the export of IT goods—particularly software—heightens the risk of cyber insecurity. Attention
to North Korean offensive activity in cyberspace is mounting, following the attempted theft of nearly

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\(^3\) United Nations, “The List established and maintained pursuant to Security Council res. 1718,” generated April
25, 2018, 
en/dprk-r.xsl

\(^4\) US Department of the Treasury, “Treasury Sanctions Suppliers of North Korea’s Nuclear and Weapons
releases/Pages/sm0099.aspx.

\(^5\) The Munitions Industry Department was sanctioned by the United Nations on March 2, 2016, for its role
overseeing the DPRK’s ballistic-missile program.

\(^6\) Executive Office of the President, “Imposing Additional Sanctions with Respect to North Korea,” Executive
20647/imposing-additional-sanctions-with-respect-to-north-korea.
one billion dollars from Bangladesh’s account at the Federal Reserve Bank of New York\textsuperscript{7} and the worldwide WannaCry malware attacks,\textsuperscript{8} both of which have been attributed to the DPRK. Analysis conducted by Kaspersky Lab, an internationally recognized cybersecurity firm, purports to reveal the modus operandi for North Korean hackers. According to their analysis, North Korean hackers initially compromise a victim’s network using remotely accessible vulnerable code or an exploit planted on a benign website.\textsuperscript{9} The former method is of particular interest as North Korean-developed software could be an ideal delivery mechanism for remotely accessible code. Though individual cases of vulnerabilities created by use of North Korean IT security products have yet to be publicly reported, the potential for such vulnerabilities undeniably exists. North Korea has repeatedly shown that it is willing to exploit its cyber capabilities for commercial and financial gain.

This report highlights these challenges using two case studies, focusing on nodes in North Korea-linked IT networks. The cases outlined are based purely on open-source information, and therefore tell an incomplete story. They also represent both a fraction of the authors’ wider research on this subject, and a fraction of North Korean IT networks themselves. As a result, this report is merely a starting point for a necessarily larger conversation over the threats and risks posed by North Korean involvement in the commercial IT industry, and how best to address them.

The Korea Aprokgang Technology Company Network

Investigations into North Korean IT companies overseas reveal the key role played by the Korea Aprokgang Technology Company, whose business is known to span Russia, China, Southeast Asia, and Africa.\textsuperscript{10} According to a 2002 business publication, the company has “led the IT industry in North Korea since the 1990s,” with a specialization in biometric information technology products and software for security applications.\textsuperscript{11} The same publication claimed the company then had 400 IT workers, and that it had “shipped security products based on its fingerprint authentication technology and personal authentication system to China, Thailand, Japan and Nigeria.”\textsuperscript{12} Aprokgang claims to have won two gold prizes for its fingerprint recognition and scanning software at the International Exhibition of Inventions in Geneva during the 1990s.\textsuperscript{13} Other North Korean companies have made similar claims.\textsuperscript{14}


\textsuperscript{10} A.k.a. Korea Aprokgang Technology Development Company (KATDC).


\textsuperscript{12} Ibid.

\textsuperscript{13} Ibid. The Exhibition did not respond to repeated requests for information.

\textsuperscript{14} Chosun Technology Company supposedly won a prize for a fingerprint device at the same exhibition, albeit in 1996. See North Korea: Investment & Business Guide, p. 257. CNS has been unable to independently confirm such claims, although the Korea Central News Agency has referenced those made by Aprokgang. See “Korea Amnokgang Technology Development Corporation,” KCNA, September 25, 2002. Accessed via www.KCNAWatch.co. It is possible that these companies won their prizes under different names. There is precedent: the KCC supposedly participated in the 1999 China World Computer Fair under the name of an...
Aprokgang has continued to be active since the 1990s. In or around 2006, it appears to have outfitted the civil service in Rivers State in Nigeria with fingerprint and card scanners. The Nigerian team that set out to find appropriate contractors reportedly searched “all over the place, until their ship berthed at the shores of KATCO Limited [the Korea Aprokgang Technology Corporation].” The company is registered in Nigeria as “Katrad Aprokgyang Technologies Company,” and remains a live entity.\(^{(15)}\) It is unclear how precisely the Nigerian officials tasked with procuring new security systems for River State arrived at Korea Aprokgang’s “shores.”

There is evidence that Nigerian contracts may have run through China. The press release regarding the River State deal mentions that those responsible for procurement made “the ultimate discovery of PEFIS,” a brand trademarked by the Katrad Aprokgang Technology Co in Lagos, Nigeria, that features a fingerprint as its logo.\(^{(16)}\) Web searches for PEFIS reveal that it is a Beijing-registered firm formally incorporated as PEFIS Electronic Technology (Beijing) Co. offering a range of biometric security products, from fingerprint scanners to facial recognition software and card readers.\(^{(17)}\) Some of these products are displayed on a corresponding Chinese Ministry of Commerce page for the company.\(^{(18)}\) PEFIS also purports to be the “first developer of a fingerprint lock in China,” and to have received four gold prizes at the International Exhibition of Inventions—a claim that corresponds with that made by Korea Aprokgang.\(^{(19)}\) This link is borne out by corporate registry documents, which show that PEFIS was a live company, through January 2018, with the Korea Yalu River Technology Development Association as a primary shareholder.\(^{(20)}\) “Aprokgang,” or its alternate romanization “Amrokgang,” is the Korean name for “Yalu River.”

PEFIS was first registered in China in 1996, using a 45 million yuan initial investment from the Korea Yalu River Technology Development Association.\(^{(21)}\) According to its latest corporate filings, the company has 14 staff, including its directors Han Zhihu (韩治虎), Li Wenshan (李文山), and Yin Yongjun (尹勇俊). Its

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\(^{(15)}\) Information from the Nigerian Corporate Affairs Commission, company number 424297. See http://new.cac.gov.ng/home/. The use of alternate romanisations of Korean names is a common challenge when conducting due diligence on North Korean corporate networks.

\(^{(16)}\) Trademark number TP. 73709/03.

\(^{(17)}\) Chinese name: 培富士电子技术（北京）有限公司, with Registration number 110000410111651. Some English translations of the name on official documentation use “Pei Fuji Electronic Technology (Beijing) Co Ltd.”


\(^{(19)}\) Note the discrepancy between Aprokgang’s claim (gold prizes in 1990 and 1994) and that of PEFIS (four gold prizes between 1990 and 1996). The reason for this discrepancy is unclear.

\(^{(20)}\) While a company number is provided for this shareholder, they do not appear to be separately registered as a legal entity in China. Official corporate registry document also suggests that in 2015, the shareholder was listed with a slightly different name (朝鲜鸭绿江技术开发总会社) compared to the one usually offered (朝鲜鸭绿江技术开发总会社). It is unclear whether this represents a significant change.

\(^{(21)}\) In 2018 valuation, this equates to approximately 62 million yuan, or USD $9.7 million (Annex 1). Beijing Administration for Industry and Commerce, National Enterprise Credit Information Publicity System.
annual return figures are not disclosed on official paperwork, but are available via third-party sites.\textsuperscript{22} Annual sales for 2016 reportedly amount to 274 million yuan (USD $42 million), though recorded profit is only 205,000 yuan or USD $34,000 (Annex 2). It is unclear whether these figures are accurate, as amounts recorded for tax paid by the company would be equivalent to a 0.05% tax rate. The company filed annual reports through 2016, demonstrating its recent activity in the Chinese IT sector.

Pefis’ business license was revoked by the Beijing Administration for Industry and Commerce on January 22, 2018, ostensibly for violating UN resolution 2375 (2017). That resolution—adopted 11 September 2017—required countries to prohibit joint ventures and cooperative entities with DPRK entities or individuals, mandating the closure of existing joint ventures by 9 January 2018. Despite China’s administrative action against Pefis, a welcome example of sanctions enforcement, the company’s website and page with the Ministry of Commerce both remain active at time of writing.\textsuperscript{23}

Further research indicates that one of PEFIS’ sources of profit may be the sale of its software and algorithms to other major biometric security firms. The PEFIS home page features a set of links to other Chinese companies producing fingerprint scanning products (Annex 3). One is for a company that appears to be Chinese owned and operated, though there are indications that its products may use North Korean software. Several separate business-to-business websites marketing the company’s products claim that its products use North Korean algorithms (Annex 4). Some of the advertisements state that the product is a “new version of North Korean algorithms with dependability and accuracy…[and] identification speed obviously improved.” In fact, as demonstrated in Annex 4, a search for the same phrase reveals many more potential suppliers of products claiming to integrate North Korean algorithms. This software may be supplied by PEFIS or its parent firm, though CNS cannot confirm this. If accurate, through the Chinese company’s distributors and partners, the products and their integrated North Korean software is on sale in every continent.

Another Chinese manufacturer identified on the PEFIS site is also active in the biometric security arena. They, too, describe their fingerprint scanners as having a “world-class algorithm,” though with no mention of North Korea or any foreign provider of it. However, their product interface bears striking resemblance to one advertised by a Malaysian company, which states that it uses algorithms that won gold prizes at the International Exhibition of Inventions in Geneva during the 1990s. Though it cannot be confirmed, the similarity in claims suggests it could be a reference to the same prizes won by Korea Aprokgang. Furthermore, the screen on the Malaysian product fingerprint time recorder is almost identical to that of a fingerprint time recorder sold by one of the PEFIS-linked Chinese companies. Both show a time around 10am, a date stamp of 2015, and a backdrop of a desert and blue sky (Annex 5). It is unclear whether these similarities exist because they use the same underlying software, or whether there are other explanations.

Further research links PEFIS to an Aprokgang-affiliate in Russia. The affiliate—EMA, LLC—is 49 percent owned by Korea Aprokgang.\textsuperscript{24} Since its incorporation in 2008, EMA has engaged in behaviors similar to other Aprokgang companies selling biometric security devices. This includes the manufacture of computers and peripheral equipment, electrical installation, and joinery installation. EMA possesses a

\textsuperscript{22} From 2014, Chinese authorities no longer publish certain types of financial information, including shareholding contributions.


\textsuperscript{24} Russian name: ООО ЭМА, with Tax Identification Number (ИНН) 6501196130. Its full name in Russian is ООО Электроштаб Амноккань. The remainder of the shares are held by a Russian company.
2009 consignment certificate for biometric locks model FOC568 manufactured by PEFIS, which corresponds to an entry on the PEFIS website.\(^\text{25}\) A matching lock\(^\text{26}\) is advertised by a Russian security company as the Aprokgang-568 (Апроккан-568).\(^\text{27}\) That company shares its registered address and phone number with EMA. Its owner is also the general director and majority shareholder via another Russian security company of EMA. Korea Aprokgang also has an active representative\(^\text{28}\) in Vladivostok, though it is unclear whether this “Aprokgang” is the same entity as the Korea Aprokgang Technology Development Company in Pyongyang, or whether it is affiliated with a parent company or other firm in the corporate group.

These activities suggest that, despite the sanctions regime, Korea Aprokgang and its affiliate companies (including PEFIS) are able to successfully form diverse corporate partnerships and develop business in the global market for biometric security products and software. Crucially, it appears that a key part of their business is not the sale of physical devices, but of intangible technology transfer. This shift will only make it harder for investigators to uncover the activities of this network and others involved in the North Korean IT sector. Furthermore, the sale of software could pose a cyber-security risk for clients.

**The GLOCOM Network**

Global Communications Co, or “Gilocom,” a defense firm operating from Malaysia that sold “radios and communications equipment, navigation equipment, Battle Management System (BMS), Command & Control System (C2S), and other customized equipment for [sic] military and para-military organizations, secret service and security organizations, and specially authorized civilian governments at home and abroad.”\(^\text{29}\) In February 2017, the United Nations Panel of Experts established pursuant to resolution 1874 exposed Glocem as a North Korean front controlled by the country’s intelligence agency, the Reconnaissance General Bureau.\(^\text{30}\) A Reuters special investigation published shortly thereafter revealed a web of Glocem-linked individuals and benignly named front companies operating in Malaysia, Singapore, and further afield.\(^\text{31}\) Together, they showed how key North Korean individuals based in Pyongyang and Kuala Lumpur were able to establish this network and facilitate years of illegal arms-related sales, gaining access to local bank accounts and major defense trade fairs.

**WCW Resources and Adnet International**

Little-noticed at the time of the investigation were the two IT companies within the Glocom network.\(^\text{32}\) WCW Resources Sdn Bhd, registered in Malaysia in November 2015, remains active at the time of writing.

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\(^{25}\) Registry number POCC CN.АВ71.А00442, issued October 23, 2009.

\(^{26}\) Referred to in the consignment certificate as the FOC568, sold by PEFIS as the FOC568PET and by FinEko-Rosa-1 as the Aprokgang-568 (Амроккан-568).


\(^{28}\) Russian: Пред ОТЗ “Апроккань,” Tax Identification Number (ИНН) 9909344990.

\(^{29}\) “About Glocom” section, [www.glocom-corp.com](http://www.glocom-corp.com).


Though no North Koreans appear as directors, WCW’s majority shareholder is Kim Chang Hyok, the North Korean at the center of the Glocom network in Malaysia. The firm offers a range of “computer consultancy” services spanning web and software development.

Similarly, Adnet International Sdn Bhd, registered in 2015 by a group of Malaysian nationals and only recently dissolved, also lists Kim Chang Hyok as a shareholder. Several of its Malaysian directors also appear on the paperwork of other Glocom-linked front companies.

Adnet’s website was removed shortly after the UN named Glocom, but archived versions are available online. It advertised a range of IT products and services, from virtual private network clients and encryption services, to USB security keys, apps, and website development. The Adnet site further claims that its core technology includes “biometrics identification techniques based on fingerprint, palm-print or face identification skills, artificial intelligence techniques” and that “the fingerprint products based on self-developed fingerprint identification technique were awarded four golden prizes at Geneva International Invention Exhibitions held in Switzerland (1990~1996).” The assertion mirrors that made by PEFIS and Aprokgang. Furthermore, Adnet states that it has “old cooperative partners of tens of years in China, Russia, Japan, Nigeria and [elsewhere]” and that its products were on sale in “China, Japan, Malaysia, India, Pakistan, Thailand, UAE, UK, Germany, France, Russia, Canada, Argentina, Nigeria and other countries.”

The company’s declared employee details also merit further scrutiny. Adnet’s website stated that it had “over 500 talented technicians”; however, given the other available details about the company’s operations, it is unlikely that it would have had this number of employees in Malaysia alone. Instead, it is more likely that the firm was also drawing upon technicians—possibly North Korean—located elsewhere. Adnet’s phone number is used on social media accounts for “Zhu Taihu,” a Korean-speaking IT developer at Adnet International, according to his LinkedIn page. On the page, he notes that he is establishing a “promising IT company in Malaysia” and “can provide a lot of IT technicians as many as you want if you want…If you hire them, you’ll never be disappointed and you’ll become a millionaire.” His LinkedIn profile photo appears to have borrowed from an unrelated Indonesian man, suggesting that the profile may be fake and “Zhu Taihu” may be an alias.

Investigations also revealed Freelancer profiles for Malaysian software developers claiming to have worked at Adnet International in Malaysia (Annex 6). One states under their Adnet experience that “hiring me is hiring my members,” and purports to have been involved in the development of a vehicle recognition system, an area in which North Korean firms elsewhere also claim to specialize, as outlined in O’Neill, “Why was North Korea running a phantom cybersecurity startup in Malaysia?” CyberScoop, March 27, 2017, https://www.cyberscoop.com/north-korea-cybersecurity-united-nations-adnet-international/.

33 North Korea increasingly relies on foreign nationals to complete corporate paperwork for its networks overseas, particularly in jurisdictions where corporate records contain details of director/shareholder nationalities.
34 Information from the SSM Companies Commission of Malaysia, company number 1166441-K.
35 Information from the SSM Companies Commission of Malaysia, company number 1145090-U.
38 Ibid.
below.\footnote{“Sosit Sdn Bhd,” a firm within the MKP Group—a North Korean-Malaysian joint venture—boasts having developed a vehicle tracking software which uses GPS. See http://sosit.mkpholdings.com.my/product/index.php?part=vehicle. As with other North Korean-linked IT firms, SOSIT and individuals affiliated with it make use of freelancer websites to develop new business.} While it cannot be confirmed that this is the same Adnet as the Glocom-linked company in question, it is possible that Glocom-linked IT firms are using Freelancer profiles to conceal the North Korean origin of the services offered.

\textit{Future TechGroup}

Glocom shares its current web infrastructure with a company called Future TechGroup,\footnote{It is possible that Future TechGroup has a North Korean analogue, Miraetech Company. \textit{Mira} is Korean for future. That company’s areas of work correspond to those of Future TechGroup. Miraetech has produced devices in the fields of IT, machine-building, and geological prospecting.\footnote{This last field is of particular note: Future TechGroup also, in addition to its IT services, sells geomagnetic prospecting technologies. “Miraetech Company”. \textit{KCNA}. 30 September 2009. Accessed via www.KCNAWatch.co.} This last field is of particular note: Future TechGroup also, in addition to its IT services, sells geomagnetic prospecting technologies. “Miraetech Company”. \textit{KCNA}. 30 September 2009. Accessed via www.KCNAWatch.co.} whose expired SSL certificate is self-signed by Glocom. Future Techgroup’s website, the landing page of which now only says “coming soon,” previously advertised a “powerful and experienced info-tech community.”\footnote{Content was removed from the website <future-techgroup.com> in August 2017.} It made no mention of its physical location or who is part of this “community.” However, the previous website analyzed by CNS bears distinct hallmarks of a North Korean firm. Cached versions of the site show it advertises sophisticated technology for mushroom growing—an industry that, while out of place in their software-focused business, is distinctly popular in North Korea. The company also advertised Korean-language translation software, another red flag. In addition, the marketing video on the site featured a cover of the Rocky theme song performed by the Moranbong Band, a North Korean pop group, for Kim Jong Un.\footnote{The authors are grateful to the devoted Moranbong Band fan who pointed out this detail. A video of the Rocky theme song as performed by the Moranbong Band is available at: https://www.youtube.com/watch?v=alYZMkkzNzk.}

The firm claimed to have recently won a prestigious award for its facial recognition software at an international competition in Switzerland.\footnote{The competition is not related to the International Exhibition of Inventions in Geneva. \url{https://web.archive.org/web/20170220014915/http://future-techgroup.com/}.} Further investigations into the competition supported this claim in part. The software in question, however, had been entered by a seemingly reputable not-for-profit entity in a US-allied country, not by a North Korean firm.\footnote{In line with the apparent North Korean signatures on the Future TechGroup website, a video held by the authors that demonstrates the software appears to feature Korean individuals.} The authors have refrained from publishing full details of this partner company, as our research suggests that it was probably genuinely unaware of their software supplier’s connection to North Korea—a link effectively obscured by the evasive tactics adopted by Future TechGroup-linked individuals and entities. It is the opinion of the authors that even reasonable due diligence performed by the company may not have sent up red flags.

In addition to its claims to major international prizes, Future TechGroup advertises past website development projects—including one for a US primary school—and purports to have sold their facial recognition software to Turkish and other law enforcement agencies. CNS could not verify these claims.

If true, how could a seemingly North Korea-linked IT firm manage to successfully permeate the global security marketplace in this way without being detected? One possibility is that individuals linked to...
Future TechGroup formed business links in the way that many programmers do: freelancing websites. Further research into information presented on the Future TechGroup site revealed freelance profiles on Freelancer.com and Guru.com for a Vietnam-based facial and object recognition software specialist called “Richard Minh.” Product images on those Freelancer pages are identical to the product videos and images on the previous Future TechGroup site (see Annex 7).

Richard Minh’s Freelancer profile is under the username “kjg197318,” suggesting that “Richard Minh” could be an alias and his username corresponds to his true initials and possibly birthdate. Freelancer pages show that “kjg197318” has won a number of contracts around the world, including for license plate recognition software for a customer in Turkey and a range of clients in North America and Europe. According to the parallel Guru.com profile, Richard Minh preferred to take payment for work by PayPal.

The Vietnamese connection is further strengthened by one of the pages from the Future TechGroup website. In demonstrating the vehicle recognition software, the example used appears to be a Vietnamese license plate (see Annex 8). Vietnam recently announced that it had denied visas for more than twenty North Korean IT workers, though it is unclear whether they were connected to this case.

North Korean evasion cases like this prove the effectiveness of Pyongyang’s approach: use simple obfuscation methods and replicate them on a large scale. Basic tactics like hiding in the volume of foreign Asian business, creating front companies with non-descript web footprints, and using aliases are often enough for North Korea to convince outside eyes that nothing is amiss. In addition, North Korean individuals using freelancing websites can often act with even greater levels of anonymity. These tactics seem to have fooled both major international competition and at least one reputable defense firm in a US-allied country. The outcome is that foreign governments and law enforcement agencies may have inadvertently and indirectly paid North Korea to develop software they currently use.

Conclusion

The case studies included in this report provide merely a small window into the front companies, intermediaries, and foreign partnerships that have allowed North Korean IT offerings to find their way into public- and private-sector supply chains worldwide. Pyongyang’s activities in this sector are far larger than detailed in this report, and larger still than what is appreciated in the public conversation over North Korea’s overseas footprint.

The challenges this activity creates for policy and cyber security could be comparatively substantial. The continued sale of North Korean IT goods and services undercuts the UN sanctions regime in several ways. Generally speaking, it represents a continued source of revenue for North Korea, albeit one that is difficult to quantify given the approach to contracting and lead generation that appears to occur. Commercial freelancing profiles, and North Korea’s general commercial networks, seem to be increasingly used to produce new contracts that can be filled by the country’s IT developers, wherever they may reside. More specifically, as the companies linked to the Glocom network demonstrate, IT

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47 See, for example: https://www.freelancer.com/projects/android/project-for-kjg-14117250/

services seem to be benefitting parts of the North Korean system that have a role in the country’s military programs.

The result is that IT products and services sold overseas by the North Koreans may be blunting both the effect of targeted sanctions on certain entities of concern, as well as on the regime more broadly. A more general treatment of the IT sector within multilateral and unilateral sanctions regimes could help. At present, these IT-related sales are sanctionable only if they violate bans on joint ventures, designations of individuals or entities, or migrant labor restrictions. While parts of Korea Aprokgang’s Nigerian and Russian networks appeared to be structured as joint ventures, and while the Glocom network has confirmed ties to the sanctioned Reconnaissance General Bureau, ascertaining and substantiating linkages between IT companies and existing sanctions is likely to require more effort than most countries are willing to exert. Even with changes to the sanctions regime, restricting North Korea’s activity in the global IT sector will pose an operational challenge. North Korean networks continue to create elaborate guises to fool their interlocutors into thinking they are of another nationality. Intangible forms of revenue generation, like North Korea’s sale of algorithms or any software development offshoring, are also intrinsically harder to stem than tangible ones. Governments lack opportunities to physically interdict such exports, and even countries with comparatively sophisticated export-control arrangements struggle to develop feasible approaches to managing intangible technology transfers.

Perhaps the best chance of disrupting this activity rests on disrupting the networks involved. In contemplating the shape of any sanctions that cover North Korean IT, governments should seek to create sector-wide authorities to take aim at major players in North Korea’s IT industry. As indicated above, this has yet to occur at the UN level, and the Korea Computer Center is, at the time of writing, the only IT company sanctioned by the United States.

Government guidance to the private sector—particularly those operating in industries in which the North Koreans specialize, such as biometric identification—would also be useful. Such action would clearly demonstrate to the private sector the need to be alert to DPRK IT services and to take this problem seriously. It could also provide specific examples of DPRK action they could look to and guard against. Companies and other actors outsourcing IT goods and services—especially those in high-risk industries—should augment and expand their due diligence practices when contracting using freelancer websites or providers in Asia.

Without such steps, North Korea’s activity in the IT sector is likely to continue to pose an under-appreciated cybersecurity threat. At present, it seems that many affected clients have unwittingly engaged North Koreans. While the level of access Pyongyang may have into their customers’ systems and data depends upon the services rendered, there is demonstrated potential for North Korea to exploit these relationships for its cyber activities. As long as North Korea’s IT sector remains in the shadows, Pyongyang’s concerning sale of such goods and services will likely continue unabated.

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49 Similarly, according to the US Treasury, the KCC “generates money for the North Korean regime through software development and programming,” including for the sanctioned Munitions Industry Department, and “is reported to have overseas locations in Germany, China, Syria, India and the Middle East.” Department of Treasury, “Treasury Sanctions Suppliers of North Korea’s Nuclear and Weapons Proliferation Programs.”
About the Authors

Andrea Berger is a Senior Research Associate at the James Martin Center for Nonproliferation Studies (CNS), where her current research focuses on East Asian nuclear issues, proliferation networks, and export controls and sanctions. Andrea is also an associate fellow at King’s College London and at the Royal United Services Institute for Defence and Security Studies (RUSI). Prior to joining CNS, she was the Deputy Director of the Nuclear Policy team at the RUSI, and an analyst in the Government of Canada.

Cameron Trainer is a Research Associate at CNS. He is a graduate of the University of St. Andrews, where he studied International Relations and Russian.

Shea Cotton is a Research Associate at CNS in Monterey. He supports the Export Control and Nonproliferation Program (XNP) at the James Martin Center for Nonproliferation Studies at the Monterey Institute of International Studies. His primary area of study is on US export controls and their effects on industry compliance. Shea built and manages the North Korea Missile Test Database that tracks North Korea’s missile-testing activity. He earned his BA and MA from the University of Georgia.

Catherine Dill is a Senior Research Associate in the Export Control and Nonproliferation Program at CNS. She has a broad research portfolio that includes analyzing nuclear and missile programs and nonproliferation and export-control policies in East Asia, illicit procurement networks and nonproliferation sanctions, and the effect of emerging technologies on nonproliferation policy and strategic stability. Catherine helped to establish geo4nonpro.org, a crowdsourcing website dedicated to analyzing satellite and remote sensing imagery of sites of nonproliferation and defense interest. Catherine holds an MA in Nonproliferation and Terrorism Studies from the Middlebury Institute of International Studies at Monterey, and a BS in Foreign Service from Georgetown University’s School of Foreign Service. Previously, Catherine worked as a senior consultant at Booz Allen Hamilton in Washington, DC.
Annexes
Annex 1: Corporate Registry Documentation for PEFIS Electronic Technology Co.


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北京市工商行政管理局

行政处罚决定书

京工商朝字〔2018〕第128号

当事人：培富士电子技术(北京)有限公司
住所：北京市朝阳区胜古中路2号院8号楼223-225-227室
注册号：11000041011651
法定代表人：李文山

经营范围：生产指纹识别系统及民用指纹系统软件；提供技术咨询、技术服务；销售自产产品。（依法须经批准的项目，经相关部门批准后依批准的内容开展经营活动。）

按照2017年9月12日联合国安理会第2375号决议、商务部工商总局关于执行联合国安理会第2375号决议关闭涉朝企业的公告（2017年第55号）的规定要求，朝鲜实体或个人在中国境内设立的中外合资经营企业、中外合作经营企业和外资企业应自联合国安理会第2375号决议通过之日起20天内关闭。截至2018年1月9日，当事人仍未办理注销登记。

上述事实有联合国决议、商务部和工商总局公告、现场检查笔录、北京市企业信用信息网企业信息等证据佐证。

我局于2018年1月16日向当事人送达了京工商朝企监听告字[2018]第10号《行政处罚听证告知书》，告知当事人我局决定作出行政处罚决定的事实、理由、依据、内容以及当事人依法享有的陈述权、申辩权和要求举行听证的权利。当事人在法定期限内未提出陈述、申辩意见。

当事人的上述行为违反了《中华人民共和国企业法人登记管理条例》第二十条的规定，构成了不按规定办理注销登记的行为。依据《中华人民共和国企业法人登记管理条例》第二十九条第一款第
（三）项规定，决定处罚如下：
吊销当事人营业执照。
当事人如不服本处罚决定，可自接到行政处罚决定书之日起60日内向国家工商行政管理总局或北京市人民政府申请复议，也可以自收到行政处罚决定书之日起6个月内向北京市海淀区人民法院提起诉讼。

北京市工商行政管理局
二〇一八年一月二十二日

Source: www.TianYanCha.com, accessed January 2018 and as it appears at time of writing.

### 培富士电子技术(北京)有限公司2016年年度报告

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Annex 3: Website for PEFIS Electronic Technology Co.

Source: www.pefis.cn/en, accessed April 2018 and as it appears at time of writing.
Annex 4: Example Listings for Fingerprint Scanners on B2B Websites

Source: www.bossgoo.com, accessed January 2018 and as it appears at time of writing.
New version of North Korean algorithms with dependability and accuracy, identification speed obviously improved, process 3,000 fingerprints, no matter good or poor, within 0.7 second.

- Built in embedded standalone module (ZKS710) with high performance SAMSUNG 32 bit X-scale CPU, big capacity FLASH and CMOS chips, it is easy to integrate with various systems.
- Alarm clock function for giving the correct time
- Be equipped with system of calendar which is on an equal footing with PC.
- Sensor with quality image, accepts dry, wet fingers.
- Support 360-degree rotation identification, easy to use.
- Adjust image distortion, assure fingerprint matching consistency.
- Accept ODM or OEM, providing system local voice, menu language, software analysis, casing-making.
- It is a good option for enterprise / factory / office / bank use.

Technical Parameters:

- Fingerprint capacity: 3,000
- Transaction Storage: 80, 000
- Period of data: Keep data for 3 years when no current.
- Collecting rate: Port rate (9600BPS, 19200BPS, 38400BPS)
- Verification mode: 1:N
- FAR: <0. 0001%
- FRR: <0. 01%
- Response time: <0. 7 second
- Alarm clock: embedded alarm clock
- Communication: RS232, TCP/IP, U-Disk
- The capacity of connecting net: 31 units (RS485 mode), 255 units (TCP/IP)
- Show: Time, ID number, Name
- Language: English, French, Spanish, Czech, Indonesian, Portuguese, Turkish and so on
- Working mode: Time & attendance, standalone, can working persistently

Source: www.tradekorea.com, accessed January 2018 and as it appears at time of writing.
ZKS GROUP CO., LIMITED

**Products (20)**

**CCTV Camera** (16)
- Home Security (15)
- Surveillant Camera (7)
- Video Door Phone (14)
- Central Lock (1)
- Surveillant Equipmen (13)
- Electronic Safe (2)
- Security Gate (10)
- Fingerprint Lock (9)
- Proximity Sensor (15)
- Safe (17)
- Video Doorphone (2)
- Home Safety (13)
- Door Monitor (9)
- Parking Sensor (5)
- Video Camera (2)
- Intercom (4)
- Rescue Equipment (1)
- Door Screen (1)
- Electric Lock (2)
- Electromagnetic Lock (1)
- IC Card Lock (2)
- Dome Camera (1)

**Other Companies**
- Pesh Group
- Mun Mun Enterprise
- Shanghai Delex Mould Pro
- New Top Electronic Facto
- Guang
- Brand Solutions India
- Shenzhen Yongchen Technolo
- Calcutta Plastic Indust
- Sengar Offset
- Dongviao Biotechnology C
- Neil Chemical
- Shenzhen Yierqiao Station
- Modest Infrastructure Ltd
- S.N. Hardwaremart
- Emerio
- Consultanat
- Martino
- Zera Consultancy
- Md
- Ore
- Innospacer Engineering T

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**ZKS-T2B Fingerprint Time Attendance & Access Control**

T2B is an innovative stand-alone fingerprint recorder that can be used in both Time Attendance and Access Control applications, it adopts advanced North Korean algorithm which integrates ZKS fingerprint matching software, low price with good performance, designed specially in the purpose of popularizing the fingerprint products. It could store 3,000 fingerprint templates and 80,000 transaction records. It is a kind of selection for your attendance and security purpose.

T2B-professional time attendance and access control system RS232, TCP/IP, USB, Embedded alarm clock 3000 fingerprint templates.

- New version of North Korean algorithms with dependability and accuracy, identification speed obviously improved, process 3,000 fingerprints, no matter good or poor, within 0.7 second.

- Built in embedded standalone module (ZKS710) with high-performance SAMSUNG S3C2410X and X-scale CPU, big capacity FLASH and CMOS chips, it is easy to integrate with various systems.
- Build in alarm clock to give correct time.
- Be equipped with system of calendar and is on an equal footing with PC.
- Sensor with quality image, accepts dry, wet fingers.
- Support 360-degree rotation identification, easy to use.
- Adjust image distortion, assure fingerprint matching consistency. Accept ODM or OEM, providing system local voice, menu language, software analysis, casing-making.
- It is a good option for enterprise / factory / tax / bank use.

**Technical Parameters:**
- User capacity: 3000 (Can expand to 5000, 10000)
- Transaction Storage: 80000 (Can expand to 200,000)
- Period of data: Keep data for 3 years when no current
- Collecting rate: Port rate (9600BPS, 19200BPS, 38400BPS)
- Verification mode: 1: N, 1:1
- FAR: <0.0001%
- FRR: <0.01%
- Response time: <0.7 second
- Communication: TCP/IP, USB
- Alarm clock: embedded alarm clock
- Door access control: Connect EM lock and EM bell.
- The capacity of connecting net: 31 units (RS485 mode), 255 units (TCP/IP)
- Distance: 1200m (RS485)
- Show: Name, time, ID number
- Language and voice: English, French, Spanish, Czech, Indonesian, Portuguese and Turkish etc.
- Working mode: Time & attendance, standalone, can work persistently
- Time & Attendance mode: Fingerprint and password
- Save function: Turn off device automatically for saving
- External function (access control): Connect to external E-lock, E-bell and annunciator
- Size: 188*50*146mm
- Power supply: DC9V, 1A (AC 100V to 240 V, 50 to 60 Hz )
- Warranty of period: 24 months
- Temperature and humidity: 0 - 45, 20%-80%
- Optional: Proximity or Mifare card reader, USB and Backup battery
- Applications: Factory/office/bank/hotel etc.

**Modal No. : ZKS-T2B**

Source: [www.indiatradepage.com](http://www.indiatradepage.com), accessed January 2018 and as it appears at time of writing.
SXL-33 FINGERPRINT TIME ATTENDANCE MACHINE

R4,250-00

Download the software for the SXL-33 Fingerprint and Time Attendance Machine [HERE](#)

Category: Biometrics Time Attendance and Access Control Devices Tags: biometric machine, clocking machine, fingerprint machine, time attendance terminal

Built in battery back up

DESCRIPTION

1. Download the software for the SXL-33 Fingerprint and Time Attendance Machine [HERE](#)
2. Click [here](#) to download the SXL Series Software Manual
3. Click [here](#) to read about Biometric Technology

Features:

- Stand-alone terminal with [built in battery back up](#)
- SXL-33 is professional time attendance & access control system designed for factory, school, bank, office from medium to large size businesses.
- SXL-33 can also be used out in the field, building sites etc.
- High operation speed and registration capacity. Using the USB cable protocol 5-10 times faster than traditional serial ports.
- SXL-33 adopts new version of North Korean algorithms with dependability and accuracy.
- Adopts the ATMEL industrial chip, 200MHz dominant frequency.

ET90A Fingerprint Time Attendance & Access Control

- **Info**
  - Time Recorder ET90V is professional Fingerprint Time Attendance and Access Control System with ARM 9.
  - ET90V supports Net connection (31 units RS485 mode), 255 units (TCP/IP) User can view the device via remote visit.
  - ET90V support multi languages.
  - In addition, it has embedded alarm clock.

- **Feature**
  - New version of North Korean algorithms with dependability and accuracy, Identification speed obviously improved.
  - Fingerprint capacity: 36000; Record capacity: 100000;
  - Built in embedded standalone module with high performance ATMEL, big capacity FLASH and CMOS chips, it is easy to integrate with various systems.
  - Embedded with Alarm function.
  - Be equipped with system of calendar and is on an equal footing with PC.
  - Sensor with quality image, accepts dry, wet fingers.
  - Support 360-degree rotation Identification, easy to use.
  - Adjust image distortion, assure fingerprint matching consistency.
  - Accept ODM or OEM, providing system local voice, menu language, software analysis, casing-making.
  - It is a good option for enterprise / factory / tax / bank use.

Source: [www.epordo.com](http://www.epordo.com), accessed January 2018 and as it appears at time of writing.
Annex 5: Comparison of Fingerprint Scanners

Fingerprint scanner sold by a Southeast Asian company, where the algorithms integrated into the product allegedly won gold prizes at the International Exhibition of Inventions in Geneva in the 1990s.

Source: Company’s website, as accessed by the authors in February 2018, and as displayed at the time of writing.

Fingerprint scanner sold by a company linked to from the PEFIS homepage. The corresponding advertisement boasts “world class algorithms”. It is unclear whether the similarity in the display screens exists because of shared underlying technology, or for other reasons.

Source: Company’s website, as accessed by the authors in February 2018, and as displayed at the time of writing.
Annex 6: Freelancer Profiles Possibly Connected to Adnet International

Source: [www.freelancer.com](http://www.freelancer.com), accessed February 2018 and as it appears at time of writing.
Source: www.freelancer.com, accessed January 2018 and as it appears at time of writing. Note that the authors cannot confirm that “Adnet International Sdn Bhd” and “AD Net International Sdn Bhd” (the latter as displayed on the above freelancer profile) refer to the same entity. No entity by the name of “AD Net International Sdn Bhd” is registered in Malaysia.
Annex 7: Profile information for “Richard Minh”


Vehicle License Number Recognition

This program can be used in various kinds of system such as vehicle volume monitoring system, vehicle-theft protection system, road charges auto-management system, criminal pursuing system and so on.

Recognition Principle

It is divided largely into detection of the license number plate and recognition of number. The stage of detection of license plate is the stage of detection of the license plate from camera's image. There are several methods and typical examples are the method using information of shape of plate, neuron network method, AdaBoost method and so on.

The method using information of shape of plate which is the first used is the method which gets edge image and selects rectangular shape which can become license plate from the image. This has advantage of simplicity and disadvantage of low recognition ratio, so it is no used independently but combined with other methods. The methods of neuron network and AdaBoost learn previously many license plates and find target. They are used widely nowadays because they have high recognition ratio. The recognition of the license plate is performed by recognition of number from license plate given. This can be seen as one kind of OCR and it can get high recognition ratio because recognition target is limited to license numbers and various restricted kinds can be added.

QA

1. Can this software be used both of image and video from camera?
   It can be used for both of them. It can support full real time processing for video from camera.

2. Can this software recognize license numbers of all countries in the world?
   You know, it is different the form of license numbers in every country. This software uses form of license numbers of specified country increasing recognition ratio. For example it is very difficult to identify English word 'I' or number '1'. But if we use form of license number, we can identify easily because the English words and numbers are restricted by their position. So in order to recognize license numbers of every country it is necessary to correct program according to form of license numbers of their country. Now this software can be used practically in United States and Europe, especially in Turkey.

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