Intellectual Property and Military Diffusion

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**Introduction**

The ability to adopt successful foreign innovations is often crucial to military success. Because of the rarity of military conflict, the difficulty of testing equipment in real world conditions, and the positional nature of military power, it is important for states to benefit from others’ technological and experimental experience. As a result, states that can adopt successful foreign innovations enjoy a significant advantage in the international system.

Studies of the diffusion of military innovations have concentrated on material and cultural factors. Some scholars have evaluated the relative weights of security and cultural factors in diffusion decisions. Others have considered the incentive and ability for successful adoption and application of such innovations in light of various states’ economic, organizational, and cultural capacity. However, few (if any) studies have examined how domestic and international legal structures affect the diffusion of military technology and doctrine, thus implying an assumption that such structures do not affect diffusion. In light of this, we examine how the legal frameworks limiting the appropriation of innovations – generally known as “intellectual property law” – influence, and in some cases restrain, diffusion. We have decided to concentrate on the sub-fields of intellectual property law known as patent and trade secret law.

This article lays the foundation for development of a research agenda on how international and domestic intellectual property law affects how states make decisions about the adoption of military innovations. It does so by examining cases in which intellectual property concerns have had arguably decisive effect on the adoption of military innovations in modern great powers. The article sets forth three illustrations of the impact of intellectual property law on arms innovation and acquisition, in the hopes of developing a research agenda on the interaction of IP law and international security. The first case involves the functioning of the United States defense industry. The second tracks the proliferation of the AK-47 assault rifle and its variants across the international system. The third studies how intellectual property considerations affect the developing arms trade between Russia, China, and India. Connecting these three illustrations is the argument that intellectual property law, a fixture of both domestic and international legal frameworks, has deep implications for how “hard security” problems play out.

Effectively, this paper challenges the implied null hypothesis that “intellectual property law does not matter for military diffusion.” While no scholars make this argument directly, the complete absence of intellectual property concerns from the diffusion literature represents de facto assumption of this hypothesis. This paper argues for the alternative hypothesis: “intellectual property law affects patterns of military diffusion,” and points the direction towards further research as to precisely how this effect manifests, and how the impact of intellectual property law on military diffusion may change in the future.

**Intellectual Property and its Relationship with Military Power**

Modern military power depends, to a great extent, on technology. The advent of industrial, capital-intensive war in the twentieth century made obvious the connection between a strong defense-industrial base and military effectiveness. The strength of the defense-industrial base depends not only on its ability to produce military material, but also on its ability to innovate. Many of the weapons that won World War II were not even on the drawing board at the beginning of the conflict. During the Cold War struggle between the United States and the Soviet Union, both countries invested enormous sums in the defense industrial base in an effort to produce...

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better, more advanced weapons. In short, defense industry innovation is a key determinant of national military power. Although military power depends on other factors in addition to technology, certain doctrines and organizational forms are impossible without a proper technological foundation. In other cases, the development of new technologies can spur (or necessitate) social and organizational transformation.

The aspects of intellectual property relevant to the diffusion of military technology are those that protect inventions from appropriation: trade secrets and patents. A trade secret is considered any economically advantageous information (usually a new invention) – such as a formula, process, design, instrument, or compilation of information – which is not generally known and is kept from being reasonably ascertainable. Trade secrets are, by definition, not disclosed to the outside world. Instead, owners of trade secrets seek to protect trade secret information by instituting special procedures for handling it. Information handled as a “trade secret” gains two separate but related sets of benefits. First are the logistical hurdles on other parties’ access to the information. Second are the legal protections of such information. However the trade secret legal regime is that it provides no protection against those who uncover the secret information without engaging in improper acquisition, through reverse engineering of a properly acquired product or simply through independent creation. That inherent restriction is more manageable when the trade secret is a production process, but it limits the value of trade secrets in many contexts in which versions of the technology are accessible to others, including customers and potential customers.

Because of that inherent limitation in the protection of trade secrets, in most contexts inventors prefer to use patent protection. A patent is a time-limited monopoly granted by a government to inventors, usually in exchange for public disclosure of how to make and use their invention. The rationale is that inventors are able to temporarily charge higher prices than they would be able to charge in the face of competition while the public gets both immediate access to the technological information that could lead to further breakthroughs and, eventually, competition from copying competitors.

Curiously, there is relatively little work in political science on the relevance of intellectual property. Shadlen, Schrank, and Kurtz examine how the legal structure regulating intellectual property has spread through the international system. They argue that while national wealth represents an important determinant of adherence to international intellectual property standards, multilateral and bilateral factors also play a key role. The World Trade Organization has helped extend IP protection globally, while bilateral pressure brought by the United States has forced many states to reform their policies. However, according to Jonathan Franklin of the

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2 In the United States, patent and copyright protection is authorized in Article 1, Section 8 of the Constitution, which states that “The Congress shall have Power To … promote the Progress of Science … by securing for limited Times to … Inventors the exclusive Right to their respective … Discoveries.”


4 Ibid. For a more domestically oriented account, see Susan K. Sell, “Intellectual Property Protection and Antitrust in the Developing World: Crisis, Coercion, and Choice,” International Organization 49:2 (Spring 1995), pp. 315-349. After the Uruguay round, the GATT became the basis for the establishment of the World Trade Organization. Because ratification of TRIPS is required in order to become a member of the World Trade Organization, a country seeking to obtain the WTO’s open marketplace benefits was required to enact TRIPS-related intellectual property laws. Because of this tie-in to generally sought economic benefits, states less likely to join other international intellectual property, such as Russia and China, have at least nominally signed onto the TRIPS system.
American Society of International Law, “international intellectual property law is a patchwork area of intersecting multilateral and bilateral agreements and their resulting harmonization of national laws.”

There are two competing arguments for the relevance of intellectual property protection to international security. One argument is that wealthier states and arms producers should have a greater incentive in maintaining and fostering strong standards of intellectual property protection, to attempt to limit the extent that that arms transfers will dissipate their technological advantage. The countervailing argument is made by realists who have long argued that international legal concerns touch only lightly upon state decision-making in the security field. This argument suggests that states may resist application of intellectual property standards to the security field, or may only partially implement such standards.

Models of Military Diffusion

Over the past two decades a rich literature on military innovation and diffusion has developed in political science. The literature on diffusion in military affairs focuses on three questions. As characterized in the Davis and Eliason edited volume The Diffusion of Military Technology and Doctrine,

“The first debate concerns how one defines the diffusion process, which is critical for identifying whether or not diffusion has occurred. The key question here is whether the communication of information is sufficient to conclude that diffusion has taken place... The second debate concerns the causes of diffusion. What motivates states to adopt innovations from abroad, and what is the mechanism by which knowledge is transferred? While scholars advance various typologies, three distinct processes – competition, socialization, and coercion – drive the spread of policies across societies with different implications for what is modeled. The third debate concerns the patterns and effects of diffusion.”

Broadly speaking, the extant literature answers these questions in terms of material interest, national and organizational culture, and state capacity. Some studies bridge the gap, arguing that cultural fissures restrict state and organizational capacity. But few, if any, models of diffusion concentrate on legal factors as either enablers of, or obstacles to, innovation itself or actual adoption of innovation. The next section details the potential impact of intellectual property law on military diffusion, from innovation, to decision to adopt, to patterns of global diffusion.

Innovation

Robert Paarlberg identified technological superiority as the key factor allowing the United States to maintain its military edge, and argued that robust intellectual property protection facilitated this edge providing incentive for further innovation (as well as by protecting U.S. advances). This position accords with policy work in the field. Pentagon studies in the early 2000s emphasized the need to retain technological superiority in

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8 Paarlberg, “Knowledge as Power, 135.
numerous areas in order to maintain "warfighting dominance." These studies concluded that the warfighting capability of the Defense Department depended on continuous innovation, and that this innovation depended on ensuring competition, including the involvement of firms that are not part of the traditional defense industrial base. These studies specifically called for the United States to retain access to innovative technologies available in the commercial realm, as this access would "increasingly represent a cost and capability advantage to the U.S. defense enterprise in all areas of warfare." In particular, these studies concluded this innovation depended on ensuring competition, including firms not part of the traditional defense industrial base. One study identified twenty-four small or non-traditional firms that could be expected to contribute to maintaining US technological advantages. As a result, since 2002, the Department of Defense has made transformation of the defense industrial base – and, especially, reaching out to smaller inventive entities -- a priority. This position links US military power to American technological dominance. IP protection is not the only way to spark technological innovation (states also sponsor prizes and competitions designed to produce specific innovations), but it does give firms consistent commercial incentive to innovate.

Peter Dombrowski and Eugene Gholz argue that the believed ability to effectively expanding competition to those outside of the traditional defense industrial base oversimplifies the defense procurement process, and that traditional defense industry firms are likely to remain dominant over newcomers. Scholarship in the intellectual property law field supports the Dombrowski and Gholz position. Supporting this argument is the explanation by Davida Isaacs and Robert Farley that the limits on US intellectual property protections weaken the DOD’s ability to successfully motivate non-traditional firms’ defense efforts. First, on paper, the statutory details of intellectual property provide such non-traditional innovators with less security against certain forms of government action than traditional property owners might have. Second, in practice, excessive judicial deference to government preferences can make the defense of intellectual property rights tenuous. Without sufficient protection for patent rights, small firms have no recourse in their dealings with the government or with other government contractors. These companies lack the political clout and long term institutional relationships to ensure that the military will properly license their technology. As a result, small inventors may be disinclined to pursue inventions sought after by the military, or to make their non-patented civilian inventions available to the military.

These positions remain contested and require additional empirical research. However, it is clear that a study of intellectual property law can help illuminate our understanding of the process of defense innovation, which is the first step in technological diffusion. Firms innovate within specific intellectual property environments, and the nature of these environments affects the process and outcome of the innovation. The “strength” of intellectual property law is important, but so also the practices through which a state applies such law to its defense industrial base. Investigation of preliminary hypotheses about the impact of intellectual property law on

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11 Ibid., ix.
12 *Defense Industrial Base Capabilities Study*, 21-22; *Transforming the Defense Industrial Base*, v.
13 *Transforming the Defense Industrial Base*, v.
14 Rik Kirkland, “Don Rumsfeld Talks Guns and Butter”, *Fortune Magazine* (Nov. 18, 2002).
technological innovation, therefore, requires evaluation of state goals with respect to the defense industrial base, and of the implementation of intellectual property protections for innovators.

Decision to adopt

As suggested above, the literature on military diffusion explains the decision to adopt an innovation through a variety of mechanisms, including cultural affinity, state capacity, prestige, and national security interests. Each of the last three is potentially susceptible to the influence of IP law. This section discusses some of the most relevant theories of military diffusion in context of the potential contribution of intellectual property law. We believe that the decision to adopt can be split in two steps: Knowledge of the technological information (actual diffusion of knowledge) and the decision to adopt the technological information (implemented diffusion). In considering these steps separately, we can see the tensions created by intellectual property regimes.

Actual diffusion of technological information has been greatly simplified and made far less expensive through the global expansion and modern automation of the patent regime. In the absence of a patent system, states had two main options to gaining military technology: either gain physical access to inventions using new technology, and reverse-engineer it to determine the innovative aspects; or purchase the information from an inside source, which would have to bear his/her own risks for violating employer agreements and/or military contractual exclusivities, and/or potential criminal liability for treason and similar crimes. To the extent that those in a state use the patent system, it permits other states to gain information about its innovative technology more cheaply and efficiently. To order to obtain patent exclusivity, the inventor files a patent application that generally must contain both a description of how to make and use the invention and a description the usefulness of the invention and/or the technical problem or problems solved by the invention. The patent system requires that this information be made public, usually even before the patent is granted, and the information is organized by technological sub-field. With 21st century internet access, information regarding all major states’ patented innovations is thus globally available. Thus the patent system makes technology both more accessible to relatively poorer states, and less of a burden even on wealthier states. (Of course, to the extent that a state discourages military innovators from using the patent system, or bars that information from public disclosure, that state’s innovations are less easily accessible to others.)

By contrast, to the extent to which innovators choose to use the trade secret regime, they will be wholly secretive in a way that they might not have otherwise bothered to do. For example, even basic points of such innovation will be protected through measures such as encryption of electronic data, and personnel restrictions to such data, in order to ensure that the innovation will be entitled to “trade secret” protections.

When it comes to adoption of technological information (implemented diffusion), the patent system clearly increases costs. Placing a state’s military innovations under patent protection means that other states have several options: (1) Attempting to license the technology, thus increasing the adoption costs beyond simply the costs of re-creating the technology; (2) designing-around the patent, essentially trying to re-create the technology without violating the patent protection, which requires incurring significant costs without the certainty of success; or (3) ignoring the patent right, which risks international or bilateral political and economic sanctions.

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18 Ibid, 12.
19 Ibid, 12.
In *The Diffusion of Military Power*, Michael C. Horowitz takes an organizational perspective to argue that variations in financial intensity and organizational capital limit the diffusion of military power. Modern military operations place enormous demands on human and financial capital. Consequently, some states and societies lack the wealth and organizational capacity to successfully adopt certain kinds of military innovations. Of course, states may sometimes attempt to adopt innovations that lay beyond their means; the capability to adopt innovations may in some situations only be ascertained through a “demonstration point,” which involves some critical event or battle indicating the capability of the new weapon. Under this framework, robust intellectual property protection can help lay a foundation for national wealth (by generating incentives for innovation). But intellectual property regimes also impose additional barriers to non-wealthy states. In the case of patent exclusivities, non-wealthy states faces additional adoption costs in the form of intellectual property rents owed to innovators. Non-wealthy states may also suffer trade secret related issues, as they lack the know-how to conduct appropriate maintenance and refurbishment of weapon systems without the assistance of arms exporters. Thus to the extent that wealthy states are motivated to establish and enforce strong international intellectual property regimes, such regimes further parse out the effective military capabilities between wealthy and non-wealthy states.

Joao Resende Santos argues the neorealist case for military diffusion. States adopt military innovations because they see other states enjoying success. Fear and ambition, and expectation of military success drive adoption. States facing greater levels of threat expend greater resources in the process of emulating successful military innovations. Although Santos does not specifically investigate intellectual property, we can derive certain expectations from his model. Under this model, self-regarding, security maximizing states are unlikely to pay too much attention to intellectual property restrictions, except insofar as those restrictions enhance military capability (either through providing protection for domestic innovators or ensuring access to foreign arms producers); however, powerful states could attempt to enforce intellectual property restrictions on weaker states, punishing violators through whatever means are appropriate.

Dennis Gormley argues that a “narrative” of desirability is an important precursor to the diffusion of particular weapon types. This narrative is similar in form to the demonstration effect suggested by Horowitz, although the narrative binds together perceptions of effectiveness, prestige, and modernity. These narratives give military and civilian leaders a reason to seek the purchase of particular weapons. Along these lines, Dana Eyer and Mark Suchman established that poor countries buy expensive weapons, even when cheap weapons would better meet their needs, because international norms and prestige encourage more expensive versions. Daniel W. Henk and Marin R. Rupiya argue that symbolic logic drives much procurement strategy in African states. While these studies do not concentrate specifically on intellectual property, they do suggest that international norms and prestige concerns affect decisions to adopt. If that is the case, then norms of intellectual property compliance can

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21 Ibid, 24.
affect how states choose between military technology. Compliance with intellectual property regimes might affect the adoption of others’ military technology in at least one of several ways: (1) Pay the associated monopoly costs; (2) seek to develop replacement (“design-around”) innovation; (3) decline to adopt the innovations, if the state is unwilling to pay the monopoly costs associated with the intellectual property regime. To the extent that states, NGOs, and international organizations have effectively created, or are in the process of creating, a narrative of IP compliance, states may prefer to live with the options that IP law imposes. By contrast, to the extent that international norms and prestige play a lesser role in military choices, states might choose to ignore such rights and bear the international consequences.

Patterns of Diffusion

The effect of IP law on international patterns of diffusion of military technology is a function both of how IP changes individual state adoption decisions, and of how IP law related interactions produce emergent properties at the international level. Obviously, the state and international levels interact with regards to the formulation of international law and the development of a normative structure.

Dennis Gormley contends that international norms and international legal structures structure the decision to adopt insofar as the affect the desirability of the innovation and the material availability of its components. Some technologies, including cruise missiles and nuclear, chemical, and biological weapons, are rigorously regulated by international statute, limiting the access of many states regardless of their desire to adopt. Similarly, intellectual property law imposes economic and political limitations on the diffusion of certain technologies. Lack of either the economic wherewithal to afford advanced technology or the political connections necessary to access that technology can prevent states from acquiring foreign intellectual property.

Similarly, international norms of prestige and appropriate behavior emerge in tandem with state behavior. The development of international norms is a complex phenomenon, but the behavior of major states (alongside international organizations, non-governmental organization, and other actors) plays a significant role in establishing definitions of appropriateness. If international intellectual property law creates consequences for IP violation, states may become more careful about how they approach the adoption of innovations. Similarly, if norms develop around the honoring of IP restrictions, the means through which states seek to acquire innovations may change.

Arms exporters concerned about “copying” may resist the transfer of certain systems, even if the recipient cannot plausibly replicate the system in toto. Arms manufacturers may take greater care in assembling their international supply chains. The development of joint projects (such as the F-35 Joint Strike Fighter, the PAK-FA fifth generation fighter, and several European frigate classes) could be hamstrung by concerns about the IP reliability of some participants.

Hypothesis Testing and Case Studies

As suggested earlier, the lack of literature on the impact of intellectual property law on military diffusion means that effective null hypothesis is “intellectual property law has no effect on patterns of military diffusion.” This is to say that extant work reserves no space impact for intellectual property law on diffusion, or explicitly

27 Ibid.
discounts the constraints provided by domestic and international law. The following case studies test this null hypothesis against the alternative hypothesis “intellectual property affects patterns of military diffusion.” We adopt “patterns of military diffusion” as the dependent variable because both innovation and decision to adopt feed into pattern of diffusion; any effects that intellectual property law has on the process of innovation or on how states decide to adopt innovations will become evident in patterns of global technological diffusion. In addition to assessing the presence of an effect, this study will also examine the nature and degree of such an effect. How does IP law affect the decisions of states to develop, export, or import technology, and how does IP law affect the means through which states attempt to import technology?

We include three case studies, each of which concerns a different facet of intellectual property law. While each study represents a reasonable test of the null hypothesis, approaching the phenomenon from different perspectives helps illuminate the full extent of the question, and also lay the foundation for future research agendas. The first case examines the development and diffusion of the AK-47, including focused comparisons with its American counterpart, the M-16. This case contrasts the spread of a weapon in a context almost free of IP law with the spread of one in the context of robust IP protections. The second case study examines the recent history of the arms trade between China, India, and Russia. Russian concerns about Chinese expropriation of Russian military technology, in direct conflict to the current global intellectual property structure, have shifted the structure of the Eurasian arms trade, allowing India greater access to Russian technology than China. The third case involves an examination of suspected Chinese efforts to steal American intellectual property through cyber-attacks on public and private institutions. This case suggests that the increasing relevance of intellectual property (along with technological changes associated with the development of the internet) may have changed the nature of international espionage.

Innovation and Diffusion: AK-47

During the Cold War, the United States and the Soviet Union adopted radically different models of the relationship between industry and military organizational innovation. In the U.S. private industry met military demand, albeit with state support and in close collusion with military practitioners. In the Soviet Union the defense industries themselves were state-owned. With regards to intellectual property, American defense companies retained rights to their innovations; in the Soviet Union, no conception of intellectual property rights belong to independent, private organizations existed. Consequently, a comparison of the development processes for the two main assault rifles of the Cold War—the AK-47 and the M-16—is relevant to the argument of this article. Upwards of 90 countries may have produced over 100 million AK-47 variants, while three countries have produced fourteen million or so M16 variants. What explains the contrast in diffusion between the two systems?

We would expect variables associated with domestic organizational sophistication, external security need, and normative desirability to determine how the AK-47 and M16 diffused across the international system. To be sure, these variables had observable effects, but the treatment of intellectual property by the chief innovators also had an impact on how the weapons spread, not to mention how they were created. While we cannot hold constant many of the factors associated with the development of the weapons, including historical experience, extant organizational doctrine, and sophistication of industrial base, we can nevertheless make some observations on how intellectual property protections affected (or failed to affect) the innovation and diffusion processes in each case.

In the wake of World War II, both the Soviet Union and the United States sought assault rifles which could operate effectively in single shot, semi-automatic, and automatic modes. The desire for an infantry assault rifle came both from experience fighting the Wehrmacht (which employed primitive assault rifles to good effect) and findings indicating that soldiers inflicted most casualties at relatively short ranges. At the same time, both organizations saw an advantage in weapons that would allow soldiers to engage at ranges traditionally associated with rifles. The problem for weapons designers was to assess the tradeoffs between accuracy, hitting power, and speed in producing a gun that could become the standard infantry weapon of a mass army.

The Red Army developed the AK-47 through a combined cooperative/competitive design process. Beginning in 1946, several teams of engineers developed alternative models based on a set of Red Army requirements. During the process, teams borrowed liberally from each other's designs in order to produce the most effective weapon. This resulted in a weapon containing elements of many different designs, which consequently could not be fully attributed to the work of a single individual or team. Despite the complexity of the design process, for political reasons the Soviet government decided to credit Mikhail Kalashnikov with "inventing" the rifle. Although Kalashnikov enjoyed significant rewards from this credit, he held no property rights in the weapon or in any components of the weapon. Assignation of credit to Kalashnikov created later controversy, as different teams and team members argued that Kalashnikov had copied specific elements of other team designs.

Unsurprisingly, the Soviet Union had little regard for or understanding of intellectual property rights. The USSR did have a licensing system that granted rights of construction to allied countries, but transfers were driven primarily by political interest. In 1958 production of AK-47s began in North Korea, in 1959 in the People’s Republic of China, and in the early 1960s in Egypt. Every member of the Warsaw Pact adopted the AK-47, and developed its own production facilities, including Albania, which received the basic technologies from China. Consequently, in addition to the huge number of AK-47s produced by the Soviet Union, a significant number of these weapons were produced by Soviet allies and partners.

Definitive estimates of the number of AK-47s produced, or even of the total number of producing states, are extremely difficult to find. Small Arms Survey suggests that as many as 100 million or more AK-47 variants have been produced worldwide. Monitoring production of AK-47s is made more difficult by the phenomenon of unlicensed "craft" shops, which produce an uncertain number of weapons. As many as 90 countries may, at one time or another, have seen production of the AK-47 and its variants within their borders.

By comparison, development of the American M16 assault rifle began in the mid-1950s. In response to concerns over the effectiveness of the M14 rifle, the firm Armalite won a contract to produce a prototype rifle using a 5.56 mm round. Production of the rifle was licensed to Colt in 1959, with full scale production ramping up in the early 1960s. Colt used political connections in the U.S. Air Force to good effect in opening to the door to

31 Ibid.
32 C.J.Chivers, The Gun, 184
33 Ibid, 190.
34 Ibid, 194.
36 Chivers, The Gun, 259.
37 Ibid, 260.
39 Ibid, 279.
40 Ibid, 277.
major U.S. procurement. Transfer of the rifle to the Army of the Republic of Vietnam (ARVN) allowed Colt and its allies to argue for the gun’s effectiveness in combat conditions. The M16 would become the primary rifle of the US Army during the latter portion of the Vietnam War, although substantial teething problems limited its effectiveness.

The M16 has also diffused to a large number of military organizations across the world, becoming the primary firearm for most NATO countries and many other U.S. allies. A wide variety of manufacturers produce variants of the M16, mostly under licensing agreements with Colt, with current manufacturers operating in the United States, Canada, and China. A notable exception to production under license is the Chinese CQ assault rifle, produced by NORINCO, which also produces unlicensed copies of the AK-47 and a variety of other small arms. About 14 million M16 variants have been produced since the 1960s.

Why did the AK-47 spread so much farther than the M16? To reiterate, several factors explain the relatively greater extent of diffusion of the AK-47 than the M-16, including timing of market entry, state policy, and design. The AK family of guns was particularly well suited for military forces with poor training and maintenance capabilities, while the M-16 required much greater care and training. Nevertheless, an appreciation of the different IP environments helps illuminate the differences in diffusion patterns of the two weapons. The extant structure of intellectual property law is undoubtedly critical to the invention and spread of the AK-47 family of weapons. The weapon itself came about in a specific (and unusual) intellectual property milieu that favored collaborative development over competitive, proprietary process. The indifference of the Soviet state to market forces led to the dramatic overproduction of weapons. Soviet willingness to export licenses, production details, and trade secrets made international production of the weapon possible even for middle and low-income countries.

**Intellectual Property Law and Patterns of Arms Export**

State-imposed arms export controls are an old phenomenon. Most often, these export restrictions prevent unfriendly states from acquiring advanced military technology. States have always paid close attention to the military technology of potential rivals, even if efforts to reverse-engineer weapons haven’t always gone well. States seek access to the weapons of their potential opponents for various reasons; the United States continues to acquire Russian weapons from a variety of sources, mostly for testing and counter-measure purposes. Some states, such as Russia, import arms just to gain access to foreign technology. Thus, the potential that export partners might attempt to copy particular technologies has always lurked behind export decisions, but the increasing relevance of intellectual property to advanced industrial economies makes the concern acute. The

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42 Ibid, 278.
43 Ibid, 280.
44 Ibid, 297.
45 "Military Assault Rifles," 1.
difference between export control for the purpose of security and export control for the purpose of IP protection revolves around third party export. If the arms importing state decides to reverse engineer a technology and export it to a third country, the original exporter experiences a diminution of its intellectual property and an economic loss. This section of the paper examines the arms relationship between China and Russia, arguing that Russia has become increasingly sensitive to Chinese intellectual property violations.

From the founding of the People’s Republic of China in 1949, the Soviet Union played a significant role in Chinese arms acquisition.\textsuperscript{52} The USSR sold advanced ground, air, and sea weaponry directly to the PRC, facilitating the development of China’s military-industrial base by transferring “kits” for the production of weapons, and finally licensed the construction of weapons to Chinese industry.\textsuperscript{53} This relationship slowed after 1960, when political differences led to the Sino-Soviet Split. However, the Soviet Union transferred models of systems such as the MiG-21 fighter, later copied and put into production as the J-7 by the PRC.\textsuperscript{54} China eventually developed its own arms-export business, often selling copies of Soviet equipment at a cut rate.\textsuperscript{55} The PRC has produced over 1000 J-7 and F-7 (export version) aircraft since the 1960s.\textsuperscript{56}

Between 1968 and 1990, the Soviet Union exported no weapons to China. Most attribute the cause of this de facto embargo to the sharp deterioration in relations during the 1960s, culminating in a brief armed conflict in 1968.\textsuperscript{57} Direct Chinese purchases of Soviet (later Russian) weapons resumed with the thaw in bilateral relations during the late 1980s.\textsuperscript{58} By the early 1990s, China began to acquire huge stockpiles of Russian weapons, helping to feed an industry devastated by the end of the Cold War.\textsuperscript{59} Acquisitions ran the gamut, from advanced fighter aircraft to submarines to surface warships to a host of ordnance and electronics.\textsuperscript{60} Russia and China may even have engaged in some joint development projects, such as the Z-10 attack helicopter.\textsuperscript{61}

However, Russia has become very reluctant over the last decade to export advanced military systems to China, less because of concern over Chinese military capabilities than because of the development of China’s technological capabilities – specifically, the capability to reverse-engineer the Russian technology and use it either to fulfill domestic needs or to sell on the export market.\textsuperscript{62} China is already suspected of copying Russian aircraft and engine, and submarine designs without royalty or license.\textsuperscript{63} In a repeat of the MiG-21/J-7 situation, in 1995

\textsuperscript{55} Small Arms Survey Yearbook 2007, 24.
\textsuperscript{57} Ibid.
\textsuperscript{58} Bussert, 2011, 20.
\textsuperscript{60} Bussert, 2011, 32, 70.
Russia licensed China to build 200 Su-27 fighter aircraft, and supplied China with kits for construction. China built only 95 Su-27s under the terms of this license, instead developing the J-11, an aircraft identical to the Su-27 in many respects. China is reportedly developing a export version of the J-11 (called the J-17), and an aircraft carrier version (J-15, similar to the Russian Su-33). Russia has protested the Chinese appropriation of intellectual property, and over the past few years has sharply curtailed arms transfers.

While the Chinese have freely violated Russian patents (or at least elements of Russian technology that would fall under patent law in a Western context), they have run into difficulties with Russian trade secrets. Without the technical expertise of Russian engineers, Chinese copies of Russian designs have suffered from dreadful reliability problems. For example, the engines of China’s SU-27 fighter-bomber knock-off routinely fail after 30 hours of flight time, compared with 400 hours for the Russian-produced version. These reliability problems obviously reduce the viability of Chinese arms exports.

China’s access to Russian military technology, not to mention China’s capacity for giving its military the most effective, reliable equipment, has been jeopardized by Chinese violation of Russian intellectual property rights. This development cannot come as a complete surprise to Chinese political and military authorities, although the experience with the F-7, Ak-47, and other weapons may have led the Chinese to believe that the Russians would not take such infringement seriously. As the previous section indicated, until the late 1990s the Russian government and defense industry paid very little attention to intellectual property concerns, either in terms of trade secrets, patents, or licensing. After the end of the Cold War, however, issues of intellectual property came to the attention of the Russian state and of the defense industry.

Russia’s relationship with India provides an interesting counterpoint to its relationship with China. The Russian arms relationship with India also has a long history, without a twenty-five year political gap. The USSR began exporting arms to India in large quantities in the 1960s, a relationship that has continued to the present day. Soviet and Russia exports have included ground combat vehicles (tanks and armored personnel carriers) aircraft (fighters, bombers, transports, and helicopters), and warships (submarines, surface vessels, and most recently an aircraft carrier). Much of this equipment has been built in India under license, and there have been several significant cooperative projects (including the T-90M main battle tank and the PAK-FA fifth generation fighter). Neither Russia nor India nor China are considered good “IP citizens,” suggesting that these players view the problem primarily as bilateral and transactional. As of yet, India has no record of pirating Russian intellectual property, either domestically or for export.

As of yet, Russia’s protests over Chinese copycatting represent one of the very few examples of an intellectual property concern affecting the behavior of states. However, given the size and relevance of the China-Russia arms relationship, investigating the causes for deterioration (and whether those cause might affect other relationships) is a worthwhile academic endeavor. As major arms exporters grow more sophisticated in their

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64 Jakobson, China’s Energy and Security Relations with Russia, 14.
65 Ibid, 21.
66 Rousseau, “The Torturous Sino-Russian Arms Trade.”
70 Ibid.
appreciation of intellectual property, and more sensitive about its violation, patterns of international arms export may shift. In particular, it may become harder for habitual IP offenders to acquire foreign military technology.  

Cyber-crime and the Legal Environment of Modern Espionage

As suggested in the previous section, states have long sought access to foreign technology, whether in order to appropriate that technology for their own use or to develop effective counter-measures. However, the economic cost of being a player in the legitimate international intellectual property regime, combined with the increasing sophistication of information technology, may be driving significant transformations in the nature of international espionage. The development of the internet has provided states with new avenues for appropriating foreign technology, with the requirements of IP law providing specific opportunities for the pursuit of information about military-oriented patents and trade secrets. Consequently, critical defense technologies may be less secure from foreign appropriation today than in the past.

Over the past two decades, the United States has consistently criticized China for laxness in IP regulation, complaining that Chinese firms and government agencies use unlicensed software, and that U.S. entertainment products are often pirated. Major U.S. media outlets have similarly decried lax IP enforcement in China. The unwillingness of the Chinese government to enforce IP regulations leads to a significant loss for U.S. firms, which depend on intellectual property rents. More importantly for the purposes of this study, experts in the United States began to suspect in the mid-1990s that Chinese hackers were attempting secretly appropriate the technology -- one may guess including trade secrets -- of American firms working in critical strategic fields through a variety of cyber-attacks. Recently, a report from the cyber-security firm Mandiant argued that the People’s Liberation Army has played a central role in this process, with what amounts to the official sanction of Chinese government authorities. According to Mandiant, a unit associated with the PLA has launched attacks against 141 global firms, many operating in the defense sector. Although China is thought to the largest source of attacks, Russia and India are also suspected of appropriating intellectual property. Reports indicate that these attacks have sought draft patent information, organizational strategy and hierarchy, and trade secrets.

We do not know the extent to which U.S. military secrets have found their way into Chinese designs. Some experts suspect that the Chinese J-20 stealth fighter may use systems and components copied from American and Russian designs. Many have compared the J-20 to a cancelled Soviet-era MiG, while others have

71 Cevasco, “Export Controls,” 252.
74 Mandiant, APT1: Exposing One of China’s Cyber Espionage Units (Mandiant, 2013), 2.
75 ibid, 3.
77 Mandiant, 20.
argued that the Chinese copied key stealth capabilities from an F-117 downed over Yugoslavia.\textsuperscript{78} While the J-20 doesn't resemble the F-117 in shape, the composition of the latter's skin may have given the Chinese clues as to how to manufacture the J-20. Of course, China gained access to the F-117 skin through traditional means of espionage, but further intellectual property related to U.S. stealth technology is believed to have fallen into Chinese hands through cyber-espionage.\textsuperscript{79}

The United States government has responded to concerns about cyber-security by releasing a strategy for digital defense.\textsuperscript{80} Initial steps include creating a watch list for regular cyber-offenders, and pressuring suspected countries in bilateral fora.\textsuperscript{81} Critics of this approach have called for more robust steps, including support for lawsuits, prosecutions, and visa denials of officials from suspected countries and firms.\textsuperscript{82} At the same time, strategic theorists have debated the implications of cyber-conflict.\textsuperscript{83} The participation of an active duty PLA unit in efforts to steal U.S. defense sector related intellectual property indicates that state behavior (in the field of espionage and counter-espionage) is adapting to new technological and legal realities. The strategic relevance of cyber-crime is tied to the rise of intellectual property as a critical national concern.

This form of espionage has uncertain effects on innovation and diffusion. However, the increasing exposure and vulnerability of military intellectual property may affect state industrial and export policies. It also increases the exposure of the military-industrial complex to a wide variety of state and non-state actors. In the future, states may be less capable of securing their valuable intellectual property. On the other hand, states may devote far greater resources to the protection of such property than they have in the past, leading to different patterns of diffusion and different kinds of public and private behavior.

**Conclusion**

Assessing specific impact of intellectual property on arms transfers and the diffusion of military innovation is a research program necessarily in its early stages. While intellectual property issues represent a fast growing sector of economic statecraft, research into how economic statecraft interacts with defense statecraft remains sparse. However, these three case studies have demonstrated that intellectual property concerns have an impact at every stage of the innovation-diffusion-adoption process. The structure of ip law characterizes how states go about developing technological innovations. Intellectual property issues can intervene in the innovate-diffuse-adopt cycle at several points. First, the structure of intellectual property law can affect the ability of states to innovate, structuring the defense industrial base to meet specific needs and develop certain types of technology. Second, concern over respect for intellectual property can alter how a state exports particular kinds of arms. Finally, in combination with changes in information technology, the relevance of intellectual property to modern military technology may change the nature of international espionage.

\textsuperscript{79} Ibid.
\textsuperscript{81} Nakashima, “U.S. Launches Effort to Stem Trade Secret Theft.”
\textsuperscript{82} Ibid.
To be sure, in some cases intellectual property concerns will have minimal impact on state behavior. The transferring state may simply ignore IP issues in pursuit of a larger political goal. Intellectual property matters more when the recipient state can plausibly copycat the relevant technology, although the possibility of transfer to a third party also looms as a potential obstacle to transferring arms to a bad IP citizen. Moreover, while entire weapons may resist copying, certain subsystems (engines or electronics, for example) may nevertheless prove susceptible to theft. In this system, which can be thought of as the "anything goes" system of IP management, states beg, borrow, and steal whatever technology they can, often attempting to copy or reverse-engineer systems developed in other countries. In many ways, Iran and North Korea operate by the same rules, buying and exporting missile technology without respect for legal protections on the patents or trade secrets that go into them. This older, more traditional system of "anything goes" IP management also allows countries like the DPRK, Syria, Iran, and Myanmar to gain access to weapons without the acquiescence of Washington or Brussels, which none would receive.

Moreover, states can override intellectual property law when it becomes in their interests to do so. The Chinese case makes clear that governments may decide to simply ignore intellectual property rules in favor of short-term interest. In the American case, the US government in practice modifies intellectual property law to favor major producers. China ignored Russian intellectual property rights in pursuit of greater control over its aircraft production capacity, either assessing the need for future Russian cooperation as low or believing that the stakes would prevent Russia from complaining overmuch. Nonetheless states face costs when they make these decisions, such that in many cases it is not in their interest to do so, or at least not in the interest of a variety of domestic constituencies. China now faces obstacles to further arms purchases from Russia, obstacles it may have to overcome with side payments or may not overcome at all. India, on the other hand, continues to have access to Russian industrial capacity and know how because it remains a “good” IP citizen.

However, states face multi-faceted problems in the international system. While neither China nor Russia may have a strong commitment to the maintenance of a robust international intellectual property regime, both may in time benefit from adherence to international standards. For example, China’s position in the military export market and in the larger international economy is changing. As China comes to rely on an export market for military hardware, the salience of IP concerns will grow. By and large, exporters of high-technology equipment benefit from the strict enforcement of IP rules. As Chinese military production increases in sophistication, and as the Chinese military supply chain spreads across different countries, China’s position on IP management for military equipment may shift. Like the United States, China may always have political reasons to export weapon systems to bad IP citizens. However, in the future, China may pay increasing attention to precisely how its technology is used, and may attach strings intended to prevent the loss of Chinese trade advantages. In this sense, the politics of intellectual property are just like any other kind of power play: States seek to structure the rules of the game to their own advantage. As the economic and military profiles -- if not necessarily the interests -- of the United States and China converge, there will be more-substantial grounds for cooperation on the rules that govern the international IP regime.

Finally, to the extent that intellectual property considerations will have an impact on innovation, diffusion, and adoption, we should expect that effect to grow in the future. Intellectual property represents a growing portion of the global economy, especially in technologically and militarily advanced states. In combination with the increasing complication of weapon production and design processes, this makes the politics of IP

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management exceedingly delicate. Weapons jointly developed by several countries -- the F-35, for example -- require negotiations to reconcile different IP regulatory regimes. Every country that manufactures part of the U.S.-developed F-22, by contrast, participates in the same international IP regime. The system requires considerable legal and political intervention to work, but it nevertheless tends to protect the IP rights of major American and European defense firms. It also stands as part of the overall international IP regime, which has emerged in response to the ongoing transformation of the advanced industrial economies of Europe and the United States. As U.S. and EU exports shift from industrial products to services, software, and similar goods, IP protection has grown more important. While the legal international IP regime restricts the use of certain technologies, participation has its perks. U.S. firms feel more secure in extending production chains to countries with robust IP protection, and the U.S. government worries less about the dangers of technology transfer. To be sure, in some cases, the question of copying or reverse-engineering a particular weapon system is moot. Many recipients of advanced weapons lack the sophisticated industrial capabilities needed to produce the weapons, even on a small scale. Moreover, most countries that receive weapons from the United States wish to maintain good relations with Washington, so there is incentive for even habitual IP offenders to respect the strict IP requirements imposed by Washington.