Threats and civil–military relations: explaining Singapore’s “trickle down” military innovation

Evan A. Laksmana a,b

aDepartment of Political Science, Maxwell School of Citizenship and Public Affairs, Syracuse University, Syracuse, NY, USA; bCentre for Strategic and International Studies (CSIS), Jakarta, Indonesia

ABSTRACT
This article explains why Singapore, despite its small size and semi-authoritarian regime, retains one of the best military forces in the Indo-Pacific. It unpacks Singapore’s ability to continuously innovate since the 1960s – technologically, organizationally, and conceptually – and even recently joined the Revolution in Military Affairs bandwagon. Drawing from the broader military innovation studies literature, this article argues evolutionary peacetime military innovation is more likely to occur in a state with a unified civil–military relation and whose military faces a high-level diverse set of threats. This argument explains how the civil–military fusion under the People’s Action Party-led government since Singapore’s founding moment has been providing coherent and consistent strategic guidance, political support, and financial capital, allowing the Singapore Armed Forces to continuously innovate in response to high levels and diversity of threats.

KEYWORDS
Military innovation; Singapore armed forces; civil–military relations; revolution in military affairs

Introduction
This article seeks to explain why Singapore retains one of the best military forces in the Indo-Pacific. Particularly, it aims to unpack Singapore’s ability to innovate continuously since the 1960s – technologically, organizationally, and conceptually – and even recently joined the Revolution in Military Affairs (RMA) bandwagon. This persistent military innovation is puzzling for two main reasons. First, Singapore is the second smallest Asian country and is deprived of traditional instruments of national power including strategic depth, natural resources, and demographic capital. Second, Singapore has been a partially democratic country whose government permeates all aspects of national life. Studies show that authoritarianism, particularly centralized state-society relations, hinders military innovation. Indeed, the history of the interwar period suggests that government domination of major corporations, research centers, and the military-technological community halted innovation, while cross-national research shows that, on average, democracies produce better militaries and win more wars. Yet, despite its size and authoritarianism, according to prominent military scholar Eliot Cohen, Singapore had “molded a technologically sophisticated and large military that is capable of striking far from the island state.”

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CONTACT Evan A. Laksmana evan.laksmana@csis.or.id

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Drawing from the broader literature on military innovation, this article develops a theoretically informed argument explaining the conditions under which peacetime evolutionary innovation is likely to occur. It argues that two conditions – the nature of civil–military relations and threat level and diversity – are particularly salient. Peacetime military innovation is more likely to occur in a state with a unified civil–military relation and whose military faces a high-level diverse set of threats. This argument explains how the civil–military fusion under the People’s Action Party (PAP)-led government since the country’s founding moment has been providing coherent and consistent strategic guidance, political support, and financial capital, allowing the Singapore Armed Forces (SAF) to continuously innovate in response to high levels and diversity of threats.

Further, the nature of civil–military relations as well as threat level and diversity have shaped four activities – strategic assessment, defense research and development (R&D) as well as procurement, personnel policies, and education and training – that have been critical in shaping SAF’s capability and intent on regularly embarking in peacetime innovation. Taken together, the argument provides a theoretically structured narrative behind Singapore’s ability to move from a purely defensive posture in the 1960s to a high-tech, RMA-ready force today.

This is, therefore, an exercise in both theory generation and illustration. By developing a theoretically informed explanation for Singapore’s persistent military innovation, it speaks to broader questions surrounding military innovation in general, particularly why some are better than others at engaging in or executing it. The ability to innovate in response to changes in the strategic environment is, after all, among the key preconditions for any military to survive. Even in the absence of an imminent danger, militaries still live in a competitive strategic context, making adaptability “the prime virtue.” At the very least, as societal, political, and military-technological conditions change, it is very costly for militaries to be static in nature and capability, as a general reading of military history suggests. Why some countries such as Singapore could accomplish successful military innovation in spite of their size and regime type, therefore, is worth studying.

By way of outline, the following section will first examine the broader literature on military innovation and offer a more precise terminology to describe the Singaporean experience. It further considers Singapore’s approach to military innovation as cumulative and evolutionary. This peacetime military innovation, as it derives from the top political decision makers, is perhaps best described as “trickle down” innovation. The second section will then explain why and how states could manage to continuously engage in such innovation processes. It demonstrates how the nature of civil–military relations and threat sufficiently explains evolutionary peacetime military innovation. To examine the analytical utility of the theoretical argument, the third section empirically examines how Singapore has continued to innovate militarily over time. The concluding section evaluates the arguments’ contributions and limitations, considers their policy implications, and suggests future research directions.

**Thinking through and unpacking military innovation**

The extant literature offers numerous and conflicting answers to the basic question of why some militaries are better than others at engaging in innovation. In fact, it seems to offer a “laundry list” of different variables explaining military innovation successes, including a
“new vision of war” and a corresponding career pathway for innovative officers, an organizational climate or culture supportive of change, intervention from the political leadership, military inter- and intra-service rivalries, or a cohesive social structure. This state of the literature is partially a consequence of the search for a “grand theory of innovation,” and partially because scholars conceptualize innovation differently – from adaptation, emulation, to modernization – while focusing on different units and levels of analyses – from technological to organizational or combat arms. What we have therefore is a plethora of arguments explaining different outcomes and processes, which exacerbate the ambiguity within the literature.

Rather than spending energy on a grand theory of all military innovation at all times everywhere, we need to focus on specified sets of explanations for some types of innovation under certain conditions. To start with, this paper considers “military change” – the change in the goals, actual strategies and/or structure of a military – as the largest unit of analysis that subsumes other terms such as innovation or adaptation. In this sense, innovation can be seen as either a process (one of the pathways to military change) or an outcome (a particular type of military change). Put differently, all (military) innovation involves some form of change, but not all (military) change is innovative. Furthermore, we can consider innovation as “situationally new”; by which is meant new to the particular military organization adopting the new concepts, technologies, or structural formats, and not whether these are inherently new across different organizations.

This paper adopts the “innovation as a process” position and further defines it as two inter-related mechanisms of: (1) modifying (or adapting) existing institutions and practices of war-making to the changing strategic opportunities and constraints by (2) developing and eventually adopting new war-fighting concepts, strategies, technologies, organizational structure, and operational method. In other words, the process of military innovation requires a change in older (existing) war-fighting systems and the (subsequent) adoption of new ones. Finally, military innovation can also be further disaggregated based on the following:

1. **Operating environment (or strategic context): wartime and peacetime**
   Wartime innovation is fundamentally different from peacetime because militaries face shorter time-horizons to formulate and implement changes during war. Combat results also provide clear “feedbacks” allowing us to discern lessons learned. Overall, “the malevolent, violent chaos of war” creates particular sets of conditions for innovation that do not apply in peacetime. In peacetime, militaries must learn from past experience (or the experience of others if they never fought wars), anticipate a future war that may or may not happen, against an opponent who cannot be easily identified and who may engage in wartime violence irreplaceable in peacetime, not to mention the wide range of future technological, organizational, political, and social constraints that cannot be predicted ahead of time.

2. **Pace and speed of innovation: revolutionary and evolutionary**
   Revolutionary military innovations are often associated with new war-fighting systems (e.g. Napoleonic levée en masse) or disruptive technological platforms that profoundly shape war-fighting in a short period of time (e.g. aircraft carriers). The debate over the “military-technological revolution” (known as the RMA today) has been premised on these “revolutionary” innovations. But as opposed to these fast-paced and radical processes, evolutionary military innovation takes place over extended periods during which
tactics, equipment, and conceptions gradually improve over time across the board. Indeed, historically, most (major) military innovations have followed this incremental yet continuous improvement of existing capabilities. In other words, most militaries have embarked on a sustained spectrum of innovations, although scholars propose different labels for them, ranging from “adaptive strategic adjustments” to “modernization plus.”

(3) Breadth and scope of innovation: major and minor

Whereas minor military innovations usually involve solely tactical or technological upgrades, major military innovations are fundamental changes in how a military thinks, plans, and conducts its operations – in short, in its overall warfare capabilities and core competencies. This conception expands earlier definitions of major military innovations as the change of concepts of operation of a primary combat arm and its relation to other combat arms. These include, for example, innovation in the areas of primary mission, organizational structure, doctrinal concepts, or basic strategy. Major innovations are also recently associated with what has been dubbed as “defense transformation” policies.

(4) Initiator or sources of innovation: top-down and bottom-up

Bottom-up innovation typically began as “lessons learned” initiatives evaluating tactical engagements or implementation of war-fighting concepts. While these are typically wartime soldier-led initiatives, bottom-up innovations also occur during peacetime, as the example of interwar development of the Marine Corps’ small wars doctrine suggests. By top-down is meant the process under which the political and military leadership initiated the innovation policies – moving down from the strategic to the tactical level. Here, senior leaders (civilian or military) are the agents of innovation where they recognize the need to adapt, formulate a new way of warfare, and find ways to implement that vision.

This typological conception of military innovation should point us toward specified forms of innovation and consider different, albeit limited, theories to explain each of them. However, in explaining the Singaporean case, the theoretical framework developed in the next section focuses only on explaining the conditions under which peacetime evolutionary top-down military innovation could occur.

Threats, civil–military relations, and evolutionary peacetime military innovation

Most studies associate successful military innovation in peacetime with battlefield success or wartime victory, especially when a state clearly demonstrated a clear superiority over older techniques of battle. This “demonstration effect,” however, cannot be easily applied in cases where the military has never been engaged in warfare against an enemy. In the absence of war’s “baptism of fire,” therefore, successful peacetime innovation should be seen in how well a military fares in: (1) integration, the ability to ensure consistency and synergies in different defense policy areas, (2) responsiveness, the degree to which it accommodates constrains and opportunities in preparing for war, (3) skill, how motivated, trained, and prepared are the troops to execute future battlefield, and (4) quality, the level of human capital and technological advancement.
In essence, successful peacetime military innovation is seen when new ideas, structures, or technologies enhance the integration, responsiveness, skill, and quality of a military. Conversely, it has failed to innovate if new ideas, structures, or technologies – to the extent that are any – only enhance some aspects of the military’s integration, responsiveness, skill, and quality. While this simple dichotomy provides an ideal-type benchmark, fine-grained measurements could examine the degree of success by telling us whether the new ideas, structures, and technologies are at the level of speculation, experimentation, or implementation. The further along more the innovation moves from speculation to implementation, the higher the degree of success.

Two conditions help explain when militaries deprived of past war-fighting experience could engage in major evolutionary peacetime innovation: (1) a unified civil–military relation allowing centralized decision-making processes on defense policy to coherently and consistently permeate – or “trickle down” – from top to bottom and (2) a higher external threat level, both in terms of intensity (or severity) and diversity, incentivizing the military to regularly and seriously think about and invest in “full-spectrum” capabilities and prepare to multiple contingencies. These two conditions are jointly sufficient to produce successful peacetime military innovation and are individually necessary (but not sufficient to produce the outcome on its own).

Scholars have recognized the importance of external threats in explaining civilian control as well as military emulation and effectiveness. But threats vary based on its level and diversity. A high threat level to state survivability tends to come from the external environment, while threat diversity can be measured by either the number of specific future opponents (e.g. one or several states), or the nature and number of security issues of concern (e.g. traditional and non-traditional), or both. Higher threat level increases the urgency for militaries to monitor the strategic environment, while higher threat diversity encourages them to “hedge” and invest in multiple capabilities to operate in different environments. A combination of high threat intensity and diversity should, therefore, push militaries to ensure their war-fighting capabilities are always current – making innovation an imperative. Conversely, states with low levels and diversity of threats tend to have less incentive to continuously innovate in accordance with their changing operational environments.

However, threats alone are not sufficient to explain peacetime innovation. There are numerous cases where militaries facing high levels of threat could not innovate, including the failures of the pre-World War II armies of Italy and the Soviet Union, or most Arab militaries during the Cold War. Part of the reason for these failures is that external threats do not directly and automatically get translated into the preferences of political and military leaders. The direct effect of threats is even more diluted when it comes to envisioning the appropriate military responses. Instead, threats are generally “filtered through” domestic political institutions. More specifically, the civil–military relationship is the most salient domestic institution for peacetime innovation. Building from the well-established literature on the significance of civilian direction in shaping military innovation, civil–military relations is simply the nature of the interaction between political and military leaders, who are further operationalized as either unified or divided.

Whether civil–military relations are unified or divided largely depends on the degree of disagreement (or gap) between political and military leaders over key strategic and operational defense policies. A unified civil–military relationship (small or non-existent gap)
is seen when there is unchallenged dominance by the political leaders, where they rule and decide on strategic and operational defense policies based on their expansive and legitimate social and political bases, or there is a high level of stable and institutionalized convergence of preferences between political and military leaders. Under this condition, civilians have an easier time designing appropriate strategies and communicate their preferences to the military. At other times, this means that contentious and crippling debates about future warfare and threats and how to best deal with them are minimized. The division of labor between the military and political leadership is also more coherently and centrally guided. In short, unified civil–military relations encourage concerted action between the political and military leaders.

Conversely, a divided civil–military relation (bigger gap) makes consensus over strategic policies more difficult. It also opens the possibility that political and military leaders would fight over control of the military, which in turn fosters distrust. When politicians distrust their military, they tend to resort to draconian means to impose control, including frequent rotation of commanders, suppression of communications within the military hierarchy, isolation from foreign sources of expertise or training, exploitation of personal or group loyalties and politicization of officer promotion, surveillance of military personnel, and purges of alleged disloyal officers. These policies discourage learning within the officer corps and further reduce the capability to innovate. History contains numerous examples of strategic failure that resulted from divided or conflict-laden civil–military relations.

Taken together, the probability of a top-down peacetime innovation is highest when the state has a unified civil–military relation and is dealing with a high level and diversity of external threats. Specifically, the “interaction” between civil–military relations and threat shapes peacetime innovation through the following key activities.

**Strategic assessment**, the process whereby top military and political leaders consult with one another, analyze policy options, and otherwise participate in defense policy-making. Threats are better identified by good strategic assessments. However, civil–military tension can interfere with and impede honest strategic assessments through their impact on the disrupted or “toxic” routines through which military and political leaders share and analyze information and consult with one another over the changing strategic and operational environment. Conversely, unified civil–military relations foster good coordination at the political–military apex that improves responsiveness and integration.

**Defense R&D and procurement**, whereby states develop and/or buy weapons and equipment, one of the key lynchpins of evolutionary innovation in response to a high level and diversity of threats. Defense R&D and procurement processes, therefore, characterized by impartial professional and technical standards, rather than a politicized or corrupt process, should enhance a military’s responsiveness, integration, and quality. A divided civil–military relationship, conversely, politicizes these activities at the expense of technical standards, while a unified one might see the political leaders support and encourage a more professional R&D and procurement process.

**Officer selection and appointments**, the methods by which a military identifies individuals to advance in the hierarchy and to be appointed to key positions. How officers are selected for key positions affects military responsiveness, integration, and quality. As promotion policies get internalized, meritocratic or politicized promotion policies guide how officers think about innovation in response to threats. The higher the level and diversity of
threats, the more imperative it is that promotion policies are meritocratic. A divided civil–military relationship could see political leaders politicize officer selection and appointment, misrepresenting the nature of threats they face, and further interfere with the military’s ability to develop the expertise and skills necessary to innovate, or make such expertise hard to obtain for those few who seek them anyway.

Military education and training, the processes through which a military imparts skills and knowledge to its forces and socializes the organization’s rules; all of which have long-term implications for responsiveness, integration, and the overall quality of the officer corps. A divided civil–military relationship will induce political leaders to micro-manage the military’s education and training system (usually combined with the politicization of promotion policies) at the expense of professional development. This stifles innovative ideas and erodes “critical organizational climate” needed to ensure innovation in response to higher level and diversity of threats. A unified civil–military relationship develops procedures to promote new ideas, and without the politicized promotion policies, the military can be motivated to value the development of technical and innovative expertise.

Here, the theory makes two assumptions; in the first, civil–military relations are assumed to have long-term effects on peacetime innovation because the nature and quality of the relationship tend to be institutionalized and follow a “path-dependent” trajectory. In the second, the nature of threats are assumed as given, as they are perceived by the military and political leaders. Whether the threats are “objectively accurate” or whether some other innovations are better suited to address them are outside the scope of the argument. The following section will demonstrate how this argument explains Singapore’s peacetime evolutionary innovation.

Explaining Singapore’s “trickle down” peacetime military innovation

This section considers Singapore’s ability to join the RMA bandwagon, rather than a revolutionary outcome, is the latest iteration in an evolutionary process of peacetime innovation. This argument follows recent re-assessments of the current RMA, as driven by information technology and characterized by the rise of quality over quantity, the specialization of military hardware, and the centrality of commercial military technology. Whereas these advancements present the RMA as a revolutionary war-fighting, as a whole it resulted from multiple evolutionary innovations, including new technologies, systems, operational concepts, and force structures. Similarly, Singapore’s RMA-ready structure is the culmination of successful evolutionary peacetime innovation processes. The following parts will first describe the evolution of Singapore’s peacetime military innovation. The second part will then employ the theoretical argument proposed above to explain why and how the innovation processes could unfold the way they did.

The evolutionary innovation of the SAF

One scholar described the SAF’s force modernization trajectory as following a “continuous evolutionary path in terms of systems and structures.” This can be briefly summarized as (1) the 1G (first-generation) SAF (1960s–1970s), focused on capability development of individual services; (2) the 2G SAF (1980s–1990s), focused on consolidation and
adaptation from service-oriented strategic thinking toward conventionally oriented combined-arms warfare; and (3) the 3G SAF (2000s–onwards), focused on implementing a transition toward a joint-strategy for multi-mission type forces with capabilities ranging from defense diplomacy to select kinetic integrated strike capabilities against a wide-spectrum of threats.42 Under the conceptual umbrella of the “3G fighting force” (officially announced in 2004), the SAF has gradually pursued an RMA-oriented modernization aimed at leveraging military-technological interoperability, adaptability, and overall combat power.43

Indeed, since its inception, the SAF has been continuously innovated by adopting new operational and doctrinal concepts, force structures, and advanced technologies, which some believe reflected its “flexible defense” strategic orientation.44 Initially, the 1G posture was symbolized as a “poisonous shrimp” (based on an analogy of “easy to swallow but impossible to digest”45), where the SAF sought to defend Singapore at the water’s edge first, to be followed by a “Stalingrad-style of close combat” in urban areas.46 This strategy was predicated on the SAF’s limited offensive capabilities – its lack of manpower, firepower, and mobility – and that the British, Australian, and New Zealand forces (under the Five Power Defence Arrangement or FPDA framework) would provide military assistance.47

But as the FPDA was being scaled down in the mid- to late 1970s, and especially after the end of the Vietnam War, the SAF was forced to seriously consider a more “self-reliant” posture.48 By the 1980s, the SAF moved to a more pre-emptive deterrent strategy, dubbed a “porcupine” posture: remaining “small” but with dangerous spines that could protect the entity from afar.49 This was done in conjunction with more extensive air force development, while the army instilled a new doctrine that emphasized amphibious operations.50 These developments allowed the SAF to begin talking about achieving a “swift and decisive victory.”51 By then, the SAF experimented with planning and executing operations at the system level with a shift in emphasis from quantitative platform-centric to qualitative system-level competencies, coupled with the drive to strengthen indigenous technological capabilities to elevate operational readiness.52 This change to a more offensive and survivable posture reflected the growing maturity of SAF’s capabilities and its indigenous planning capacity in response to the increased level and diversity of regional threats.53

In the 1990s, the SAF began to further embark on high-tech innovations and developed a “smart” defense posture and strategy: symbolized as a “dolphin” representing a smart, agile, and maneuverable force able to move quickly from danger, and yet armed with sharp teeth and an ability to defend itself.54 Furthermore, with a view to exploiting new technologies and thinking, Singapore’s defense planners exploited the RMA debates in the US and elsewhere as the basis for re-examining its own organization, doctrine, and force structure. This led to the eventual adoption of the “SAF 2000” focused on maintaining and enhancing SAF’s technological advantages and improving tri-service integration.55

By the early 2000s, the Ministry of Defense (MINDEF) was prioritizing the creation of new structures and processes to explore new concepts that would strengthen inter-service and inter-agency integration.56 Subsequently, they further innovated and develop the 3G SAF, underpinned by the concept of Integrated Knowledge-based Command and Control (IKC2), which relies on superior information technology.57 With these new concepts, the SAF invested substantial resources into developing operational and organizational concepts and integrating niche advanced weapons and systems, including satellite capabilities,
airpower and precision weapons, and networked targeting. Correspondingly, the Navy, Air Force, and Army were also revamped technologically and organizationally to create a full-spectrum force capable of tackling both traditional and non-traditional security threats. All of these innovations were also put beyond experimentation and into implementation as the SAF’s force structure, war-fighting concepts, and technological capabilities improved over time – culminating by the late 2000s in an SAF that is “transformation-ready.”

Taken as a whole, the SAF has continuously innovated and evolved; from a purely defensive “poisoned shrimp,” to “porcupine” with a limited power projection, to the ongoing 3G concepts analogous to a “dolphin.” This evolution suggests that the SAF watched, learned, and adapted to its changing strategic and operational environment – indicating strong responsiveness. The conceptual and technological improvements could not have taken place without the increasing skill and quality of its officers. Overall, therefore, the SAF is a successful case of top-down evolutionary peacetime innovation.

**Explaining the SAF’s evolutionary peacetime innovation**

The SAF’s successful evolutionary peacetime innovation can be explained by both the level and diversity of threats Singapore faces and the unified nature of its civil–military relations. Singapore’s geopolitical circumstances – its small size, its location of being a “Chinese island in a Malay sea,” its lack of strategic depth, its acrimonious history, and its dependence on the outside world – have been said to instill both a deep sense of “vulnerability and exceptionalism” among Singapore’s defense planners. Indeed, the common narrative in Singapore’s strategic community is the historical experience of vulnerability – nearly an existential “angst” narrative, originating from the traumatic experiences of the fall of Singapore under the British colonial rule in 1942 and subsequent Japanese occupation and wartime deprivation until 1945, to the experiences in attaining independent international status in 1965, followed by challenges in creating a robust defense capability and socioeconomic stability in the immediate post-independence period.

These conditions gave the Lee Kuan Yew-led PAP a sense of urgency to develop the SAF to defend the Island. Following separation from Malaysia, Singapore immediately established a Ministry of the Interior and Defense under Lee Kuan Yew’s close political associate Goh Keng Swee – a civilian economist. Goh was tasked with building the SAF from scratch and as there were no officers to begin with, he placed several civil servants in key positions in the military hierarchy while the SAF prepares to institute conscription and build its officer corps. As such, many of SAF’s formative leaders were not full-time military officers; they were seconded civil servants and some were even foreign personnel. After mandatory conscription was put in place by 1967, the SAF instituted a scholarship program in 1971 that allowed its best and brightest officers to study at the best Western universities. When juxtaposed with SAF’s continuous build-up as funding increased, this pushed the development of SAF’s organization, training, doctrine, and equipment even further.

The political establishment also formulated a “Code of Conduct for the Armed Forces” in 1967, which has shaped the values and norms for the behavior, position, role, and
functions of the SAF ever since. The code stipulated a strictly professional role for the SAF as an instrument of the state and called on all members, among others, not to interfere in politics and maintain loyalty to the government. This code eventually made its way into the SAF’s value system and culminated in 1996 with the established seven core values.66

These conditions not only created an officer corps initially characterized by “civil servants in uniform,” but over time, they eventually gave rise to a civil–military “fusion” where there is hardly any fundamental disagreements between the political and military leadership regarding the SAF’s basic mission, structure, posture, doctrine, and role.57 After all, there were no critical political voids and turmoil that might have ignited military intervention, especially since the SAF’s absence during Singapore’s founding moment deprived them of a political role.58 Additionally, part of its military “tradition” had come from their colonial legacy where the military was seen as a colonial asset that lacked a common sense of mission.69 With an unchallenged PAP at the helm, a strong civilian presence within the hierarchy that was tightly integrated for the purpose of unified command and control, and an officer corps that was for all intents and purposes not politically autonomous,70 a unified civil–military relation became institutionalized.

Conceptually, the unified civil–military relation is encapsulated in Singapore’s “Total Defense” national security strategy aimed at strengthening and mobilizing resources in five mutually supportive defense domains: military, civil, economic, social, and psychological. This framework allows Singapore to offset an array of security predicaments through an integrated civil–military strategic interactions at various levels, linking the various players in Singapore’s “defense ecosystem,” between the users (SAF), developers (e.g. MINDEF, Defense Science and Technology Agency or DSTA), and producers (i.e. local defense industries).71 Therefore, the “siege mentality,” driven by high levels and diversity of external threats, allowed the PAP to decide strategic defense matters without any serious opposition or public debate while ensuring that all national strategic resources are integrated.

Furthermore, the PAP’s ability to score nearly uncontested victories in consecutive general elections also endowed them with strong legitimacy and ultimately unchallenged authority over high defense spending (up to 25–30% of annual spending), universal military service, operational readiness, technological superiority, developing integrated and balance forces, and defense diplomacy.72 This also allowed the SAF to continually improve and modernize unhindered by neither domestic economic recession (1984–1985), relaxed international strategic environment in the 1990s, nor the 1996/1997 Asian financial crisis.73 Such support, political and financial, has given plenty of room for the SAF to innovate and ultimately improve its responsiveness and integration.

This underscores the argument that Singapore’s unified civil–military relations allowed military policy to be exercised in a “top-down fashion,” mainly through the government’s control over MINDEF and SAF via three policy-making forums: the PAP’s Central Executive Committee, the Cabinet, and the Defense Council.74 Structurally, the SAF’s top brass falls under the jurisdiction of a number of civilians, including the Permanent Secretary for Defense and the Minister of Defense (also granted a large authority over SAF appointments).75 This civil–military fusion was further strengthened through the dual-career scheme introduced in 1981–1982 that allowed senior serving or reservist SAF officers to be appointed to key positions in various governmental posts.76
More importantly, this unified civil–military relation has affected various military activities critical for innovation success. It ensured, for example, that Singapore’s strategic assessment has been highly coordinated and visionary. In fact, pragmatism and realism have been the hallmark of Singapore’s foreign and defense policies underpinned by a sober and coherent analysis of their strategic constraints and opportunities. The evolution of the SAF’s war-fighting strategies – from a poisonous shrimp to dolphin – under different strategic environments is a testament to the integrating effects of a unified civil–military relations.

As an additional example, under the auspices of MINDEF and the political support provided by the PAP-led government, the Future Systems and Technology Directorate (FSTD) recently focused on the strategic perspectives and visions of future warfare based on studies of emerging operational concepts, such as how “hybrid warfare” in the Middle East and Eastern Europe could be emulated in the East Asian security context. The SAF’s Center for Military Experimentation also further encouraged innovative ideas.

In terms of capability development, particularly defense R&D and procurement, the continuously high level and diversity of threats allowed the PAP-led unified civil–military relation to continue supporting high levels of defense spending along with a strong defense industry strengthened through a close collaboration with civilian research institutions. Indeed, first-order macro decisions on defense allocation and production have been driven by political considerations. The development of the defense industry was also made possible by the strong support and guidance from the PAP since Goh’s time. Additionally, the defense industry has been set on developing niche areas with a preference for upgrading existing platforms with advanced systems. This allows Singapore to “creep” its defense capabilities forward with more discretion, while reducing the danger of publicly being seen as engaging in a regional arms race.

As early as 1971, MINDEF established the Electronic Warfare Study Group, which served as one of the key foundations for the development of Singapore’s advanced “defense technological ecosystem,” consisting of 5000 defense scientists, engineers, acquisition professionals, and logistics spread across the ministry, SAF, DSTA, Defence Science Organization (DSO), Defense Laboratories, defense industries, and research institutes. SAF’s technological innovation has since been further strengthened by the vital role played by defense engineers from government agencies and state-controlled defense industry and coordinated by DSTA, a semi-autonomous statutory board chaired by MINDEF’s permanent secretary.

MINDEF also established the Defense Research and Technology Office (DRTO) in 2006, bringing together existing research and technology planning and management units under a single agency. By 2013, MINDEF merged DRTO with its Future Systems Directorate to create the FSTD as a way to structurally entrench the operational and technological synergies of their respective roles, and in doing so, fusing both expertise to better pursue innovation. FSTD was credited with the conceptualization for the Airspace Management Technology system regulating dense aerial traffic over Singapore as well as the development of the Combat Management System onboard Singaporean Navy’s stealth frigates. These R&D developments represent Singapore’s evolutionary approach to innovation and sober assessment that science and technology is the best force multiplier for a highly diverse threat environment. They also helped sustain Singapore’s procurement
and modernization plans, which have evolved around upgrading existing equipment while selectively introducing new-generation systems. The SAF has particularly maintained a consistent “spiral” capability development in key technological areas central for its war-fighting capability across different security environments: stand-off precision, force protection, unmanned, cyber, enhanced lift and endurance, and advanced modeling and simulations. These policies have been central to SAF’s evolutionary innovation and were spurred by a unified civil–military relation and rationalized in terms of the high level and diversity of threats Singapore has to continually confront.

Meanwhile, in terms of manpower policies, Singapore’s meritocratic system that was based on the PAP’s vision of cultivating “academic talent” and grooming them into the elite has left a hallmark in SAF as well. Specifically, the meritocratic vision came from Lee Kuan Yew who believed in the universal applicability of “talent” to any situation and the need to identify those people with a tangible quality in school, pump all resources to nurturing them, exposing them to an ever-steepier hierarchy of challenges, and then select the best to face test after test. This same principle has been applied in the SAF since 1971 when they instituted a scholar-soldier program that sent second lieutenants to top universities abroad who would be advanced to the rank of major upon their return.

By the 2000s, there were five levels of scholarships for SAF officers that allow them to study at the best universities and academies abroad as well as local universities. The government also tried to ensure that officers were well rewarded financially – up to 20% more than their Civil Service counterparts. A host of other incentives and welfare schemes have also been added. The government also increased the number of available high-ranking posts – making career prospects essentially “brighter.” They also operated under a “Keep SAF Young” policy – where officers must retired by the age of 40–50 – to provide opportunities for rapid career progression and maintain an innovative military leadership. And to compensate for the end of their military careers, senior positions in the government are often made available; thus ensuring beneficial second careers for retiring officers.

Finally, in terms of education and training, the SAF’s system has been primarily geared toward external defense – although recently, they were prepared to play a supportive role in domestic emergencies. The underpinning norms and ideas that have guided the education and training system were formulated and determined by the PAP-led government. During Singapore’s nascent years, the education and training were geared more to produce high-quality, combat-fit soldiers. But the system has been constantly reviewed with the aim of adapting to the demands of a conscripted military. Thus, eventually, the entire training system is predicated upon the belief that the national serviceman is a thinking soldier who understands what is needed of him and will respond more readily to a focused and compressed course of training. This is in line with the meritocratic system of career advancement and the soldier-scholar policies discussed above.

Additionally, the SAF has also placed emphasis on integration, which can be seen in its Tri-Service Staff Course geared toward furthering the SAF’s Integrated Warfare Capability. Therefore, with this kind of focus on technical expertise in military affairs, away from politics, officers within the SAF were able to develop new innovative ideas. For example, with the advent of the IKC2, an officer had suggested the possibility of innovating along the lines of the German Auftragstaktik that involved considerable
decentralization of command and control and greater initiatives at the lower level. Overall therefore, we can see that the unified civil–military relation shaped the SAF’s education and training system.

How these four activities – strategic assessments, defense R&D and procurement activities, and personnel as well as education and training policies – come together can be seen in the systematic planning of the SAF’s 3G capability development. MINDEF, in particular, has outlined its vision of defense management reforms as well as organizational and operational adaptation into a three-phase building block approach: (1) acquire new equipment, introduce progressively more capable systems, and establish new units to enable SAF’s transformation into an advanced, networked force, (2) set up new operational command relevant with an expanded spectrum of operations and, in doing so, focus on widening its operational flexibility and responsiveness, and (3) aim on enhancing SAF’s leadership and human capital through the introduction of enhanced career schemes as well as revision of training and curriculum to maintain a steady stream of capable and committed officers. Taken as a whole, the PAP-led unified civil–military relation and Singapore’s unique vulnerabilities have driven key defense policies in such a way that the SAF could continue to innovate in response to its changing strategic and operational environment.

**Conclusion: contributions, limitations, and future research**

The preceding analysis has demonstrated how the nature of civil–military relations and the level and diversity of threats shaped four military activities that are crucial for evolutionary peacetime innovation (as measured by integration, responsiveness, quality, and skill), namely strategic assessment, defense R&D and procurement, officer promotion, and military education and training. Empirically, we have seen how Singapore’s PAP-led civil–military fusion, particularly through its management of an integrated “defense ecosystem,” has helped Singapore overcome its geopolitical vulnerabilities by ensuring that the SAF could continuously innovate in response to its changing strategic and operational environments.

Theoretically, this article sought to clarify the different ways we can conceptualize and think about military innovation processes. By focusing on specified arguments about evolutionary peacetime innovation, the article further complements and refines the “civil–military relations” school of thought in military innovation studies. It also shows the limits of the “democratic triumphalism” literature that considers regime type cross-nationally without unpacking the underlying mechanisms. Additionally, it further adds to the different ways we can understand military innovation beyond the battlefield, especially for many post-decolonization states in the Indo-Pacific region. By so doing, it helps to address the lacunae of military innovation research developed from the non-Western part of the world while contributing to broader debates about the RMA bandwagon.

Despite these contributions, however, the article has only provided a “plausibility probe” of the theoretical argument by examining Singapore’s “trickle down” peacetime innovation. We need better, systematic tests of the argument, whether through comparative case studies, or cross-national assessments of numerous countries facing similar conditions. After all, it is possible that Singapore may represent a unique case in which small
size and authoritarianism actually contributed to, rather than hindered, evolutionary military innovation. We should also develop and test specific theories about other types of military innovations in different parts of the Indo-Pacific, whether comparatively or historically.

Finally, in terms of policy-making, other countries in the Indo-Pacific wishing to emulate Singapore’s innovative successes should not neglect the significance of civil–military relations in driving forward the process. While threats can change and are often subject to different interpretations by domestic political and military leaders, having a high-quality, and preferably devoid of major gaps and disagreements, civil–military relations appear to be a necessary precondition to marshal and integrate national resources for military innovation. Of course, as the above analysis also suggests, serious and systematic attention also must be directed at key defense policies, from strategic assessments to personnel planning and education and training systems. In short, it requires a holistic, whole-of-organization approach to military planning and defense management reforms.

Notes


11. Rosen, Winning the Next War, 23.


16. Rosen, New Ways of War, 134.


25. See, for example, Avant, *Political Institutions and Military Change*. 9. I conceptualize external threat vis-à-vis state sovereignty and not the safety of the ruling regime of the day, though empirically the two may overlap.


34. Ibid., 21.


42. Ibid.

43. Ibid.


45. Ibid.


47. Raska, Military Innovation in Small States, 141.


51. Huxley, Singapore’s Strategic Outlook, 153.

52. Raska, Military Innovation in Small States, 141.

53. Ibid.

54. Loo, Explaining Changes in Singapore’s Military Doctrines, 369.

55. Huxley, Singapore's Strategic Outlook, 156; JDW 1997a: (25).


57. See Jacqueline et al., Realizing Integrated Knowledge-Based Command and Control: Transforming the SAF, Pointer Monograph No. 2 (Singapore: SAFTI Military Institute, 2003).

58. Raska, Military Innovation in Small States, 146.


60. Bernard Fook Weng Loo, ‘Transforming the Strategic Landscape of Southeast Asia’, Contemporary Southeast Asia 27, no. 3 (2005): 401.


64. Ibid.


68. Teh, The Soldier and the City-State, 53.


72. Huxley, *Singapore’s Strategic Outlook*, 142, 186.


75. Teh, *The Soldier and the City-State*, 52.


83. Huxley, *Singapore’s Strategic Outlook*, 188.


85. Ibid.

86. Ibid.

87. Ibid., 152.

88. Ibid.


91. Huxley, *Defending the Lion City*, 112.


94. Ibid., 288.

95. Huxley, *Defending the Lion City*, 113.


98. See Grissom, *Future of Military Innovation Studies*, on this school of thought.

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ORCID
Evan A. Laksmana http://orcid.org/0000-0002-5754-4266