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New ways of thinking about the global arms industry

Dealing with 'limited autarky'

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At first glance, the global supply of the most sophisticated armaments is increasingly dominated by a small number of large multinationals from a very few countries. Below that, however, there are many states that are nevertheless engaged in a variety of arms-production activities. Some countries produce equipment at lower levels of technology and capability, some operate as suppliers to the dominant defence firms, some specialise in a limited number of high-technology products, and some engage in a mixture of these three activities. This mix of technology levels makes it difficult to assess the defence-industrial capability of any given country. Similarly, the dynamic nature of the defence industry means that any given subsector might have only transient importance before giving way to some other technology (which is also true of most industrial sectors); this means that any evaluation of a nation's overall capability based on a technology breakdown can only be a snapshot at a given time.

In this light, this report attempts to explain why some countries produce arms *on a limited scale*, and what benefits they hope to accrue from that strategy.

F-22 production. Photo courtesy Lockheed Martin.

In particular, the report pays attention to the achievement of niche capabilities by smaller arms-producing states, how their governments value those capabilities, and how they may affect the military capabilities of national militaries. Consequently, the report tries to rate the potential benefits of 'limited autarky'—that is, the ability of countries to gain greater self-reliance in deemed critical areas of armaments production where national defence priorities are supposedly the highest, even if overall autarky (self-reliance) remains low. At the same time, it addresses the need to balance the costs of limited autarky (in terms of costs, technology and foreign competition) with strategic gain, if any.

The findings in this report could be of particular use to states with limited capacities for armaments production, such as Australia, when they are trying to determine which sectors of their national defence industries should be preserved or even strengthened. Is it worthwhile, for example, for Australia to try to produce its next-generation submarine? What arms-manufacturing capabilities should such a niche producer attempt to gain or maintain? Overall, how much should (and could) a second-tier arms-producer like Australia expect to be autarkic when it comes to critical areas of defence acquisition?

Why do countries build arms?

Countries have several reasons for developing and producing their own arms, perhaps of the most powerful of which is the security-driven imperative for self-reliance in arms acquisition.[1] The argument goes as follows: in what's basically an anarchic international security system, nation-states are ultimately responsible for their own security, which usually entails possessing an independent defence capability. Such a defence capability requires a military, a military requires armaments, and the most reliable source of armaments is a domestic one; hence the need for an indigenous arms industry. Depending too heavily on arms imports means exposing the nation-state to cut-offs or to technology holdbacks, thus risking its ability to acquire the weapons it deems essential to its national defence. In addition, relying too much on foreign-sourced arms can potentially threaten national political independence, as a supplier might withhold or threaten to withhold arms deliveries in order to extract concessions from or affect the behaviour of the receiving country. Embargoes, sanctions and other types of supplier restraints—whether real or potential—have tended only to reinforce the perception on the part of many states that they must establish a secure, *indigenous* source of armaments.

In addition to fulfilling perceived requirements for self-sufficiency, arms production has often been seen as an important mechanism for driving a country's overall economic development and industrialisation. Defence industrialisation had potential backward linkages spurring the expansion and modernisation of other sectors of the national economy, such as steel, machine tools and shipbuilding.[2] Industrialisation and technological advancement were seen as feeding into the development of domestic arms-manufacturing capabilities, such as by building up general skills and know-how, and providing lead-in support or equipment for arms production. For example, the construction of warships stimulated the establishment of indigenous shipbuilding industries, while the production of military vehicles required steel mills and automotive factories to provide critical parts and components, such as armour plating, chassis and engines, and skilled labour to assemble the vehicles.

At the same time, armaments production was viewed as a 'technology locomotive' spurring the growth of new industries and new technologies, particularly in the aerospace, electronics and information technology sectors.[3] Military aerospace programs, for example, often constituted the basis for civil aircraft and aviation production in nearly all of the arms-producing states. Domestic armaments production provided other economic benefits as well. Defence industrialisation could function as an import-substitution strategy; instead of sending capital (especially government monies) out of the country via arms imports, countries could use indigenous arms production to create jobs, ameliorate trade imbalances and protect foreign currency reserves. Finally, by *exporting* arms, defence firms were a potential source of foreign currency earnings.

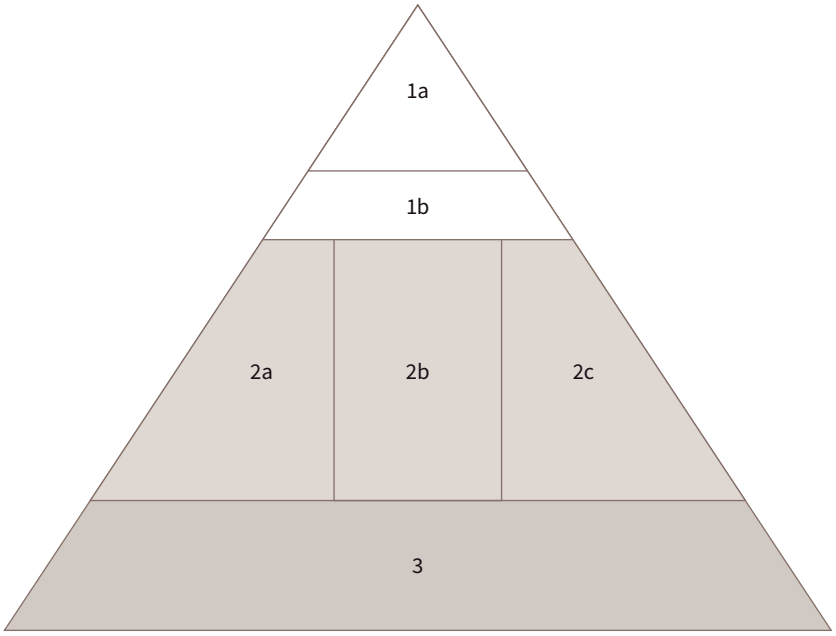
The 'pyramid' model of arms-producing states

For all those reasons, most countries pursue autarky in armaments to the fullest possible extent that they can. Of course, very few are totally or nearly totally self-sufficient in arms production. In fact, only a handful occupy the rarefied heights of a pyramid

model of armaments manufacturing. Those states possess relatively high levels of indigenous capabilities for independent defence-related R&D and manufacturing.[4] Even then, there are important distinctions: Keith Krause differentiates between the uppermost tier of arms producers (the 'critical innovators', such as the US and the former Soviet Union) and the 'adapters and modifiers' of advanced military technologies (most of the larger Western European arms-producing states, particularly France, Germany, Italy and the UK.

It's possible to refine this pyramid model even further, with horizontal and vertical divisions *within* the various tiers (Figure 1).[5] The first tier can be seen as those states with the capacity for across-the-board development and manufacture of advanced conventional weaponry. This tier consists of just a handful of countries: the US and the four largest European arms producers (Britain, France, Germany and Italy). Increasingly, the four European weapons states are Tier 1 mainly through the amalgamation of their defence-industrial capabilities via collaborative programs or the creation of pan-European defence enterprises and joint ventures. Russia fits into Tier 1, based mainly on its inheritance of the Soviet military-industrial complex, although much of its defence-industrial capacities has atrophied considerably over the past 20 years due to a lack of funding to maintain the country's defence R&D base. Given the US's preponderance of defence-industrial capabilities—especially when it comes to defence R&D, which is powered by a huge military R&D budget (more than the rest of the world's defence R&D budgets combined)—it might be more fitting to describe the US as a *Tier 1a* country, and the others as *Tier 1b* producer-states.

Figure 1: The pyramid model



- Tier 1a: Large, broad-based, technologically advanced defence industrial bases: USA
- Tier 1b: Smaller, broad-based, technologically advanced defence industrial bases: UK, France, Germany, Italy
- Tier 2a: Smaller, niche-oriented, technologically advanced defence industrial bases: Israel, Sweden, Japan, Australia
- Tier 2b: Smaller, broad-based, less technologically advanced defence industrial bases: South Korea, Brazil
- Tier 2c: Large, broad-based, less technologically advanced defence industrial bases: China, India
- Tier 3: Smaller, niche-oriented, low technology defence industrial bases: Mexico, Nigeria, Serbia

Source: Richard A Bitzinger, *Comparing Asian and global defense industry trends and the Chinese defense industry*, PowerPoint briefing, drafted 23 April 2012

At the bottom of the pyramid are the various so-called Tier 3 states, which possess only very limited and generally low-tech arms-production capabilities, such as the manufacture of small arms or the licensed assembly of foreign-designed systems. Such countries include Egypt, Mexico and Nigeria.

The middle tier is the most interesting group, as it comprises a rather catholic group of countries. It includes China and India, which seek to create large, sophisticated defence industries commensurate with their great-power aspirations. It also includes developing or newly industrialised countries possessing modest (but in some cases expanding) military-industrial complexes, such as Argentina, Brazil, Indonesia, Iran, Singapore, South Africa, South Korea, Taiwan and Turkey. Finally, this tier also includes those highly developed, industrialised countries possessing the capabilities for advanced but nevertheless limited defence production, such as Australia, Canada, Israel, Norway, Japan and Sweden.

What the Tier 2 states have in common is the aspiration to maintain or even increase their self-reliance in armaments production. Some—particularly China and India—have the ultimate objective of complete autarky in armaments. However, for most other Tier 2 countries—such as Brazil, Indonesia, Israel, South Africa and, for our purposes, Australia—such high levels of self-reliance have proved to be unattainable, unsustainable, or unimaginable from the outset. Quite simply, many of these states haven't been able to realise their most important goals for indigenous arms production despite their best efforts. They couldn't achieve or maintain either autarky (broad self-reliance in weapons design and technology) or efficiency (that is, making arms manufacturing cost-effective or deriving much in the way of economic benefits).

Advanced arms production among most Tier 2 states became increasingly untenable in the post-Cold War era. As the input demand for financial resources and technology continued to escalate, they found themselves more and more hard-pressed to maintain even their existing capacities and capabilities for armaments production.

The 'ladder-of-production' and 'innovation typology' models

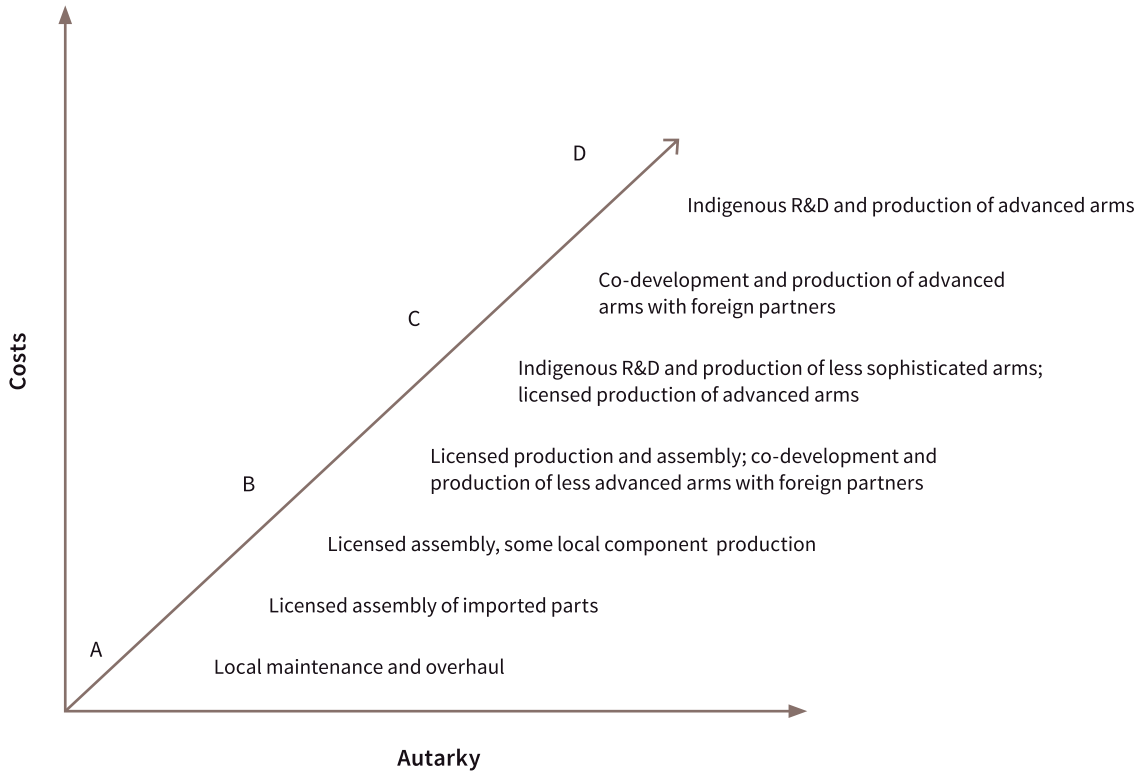
Of course, some Tier 2 arms-producing states have continued to strive for high degrees of autarky, despite these setbacks. In particular, China, India, Japan, South Korea and perhaps Brazil still appear strongly committed to constructing broad-based and advanced indigenous arms industries, driven in particular by powerful 'technonationalist' sentiments.[6]

The most commonly applied model used to describe this process of growth and advancement is the 'ladder of production', which places defence-industrial capabilities on a linear scale that relates increasing autarky to increasing costs (Figure 2).

According to the ladder-of-production model:

> [I]ndigenous arms production is a process of transitioning from extremely high to very low levels of foreign dependency for weapons and production technologies. Initial armaments production tends to rely heavily on imported technical assistance from countries possessing already well-advanced defense industries. Most second-tier arms-producing countries start out by assembling weapon systems from imported parts and components (knock-down kits). The next step usually consists of the licensed production of foreign weapon systems, with some (and, in many cases, eventually nearly all) of the actual manufacturing of components and subsystems performed indigenously. This is usually followed by limited indigenous development and production of relatively simple, 'low-tech' armaments—such as small arms, ordnance, or small patrol boats—along with the codevelopment of more sophisticated armaments in partnership with more advanced foreign arms producers. Particularly at these later stages in the ladder of production model, basic arms-manufacturing capabilities are increasingly supplemented by incremental improvements in the country's independent military R&D base. Accordingly, a country may attempt to indigenously produce more complex (i.e., 'mid-tech') weapon systems, such as light armored vehicles or trainer aircraft. Lastly, a country may attempt to design and develop its own advanced weapon systems—such as fighter aircraft, missiles, submarines, large surface combatants, or military electronics—either across-the-board or by carving out certain niches or specialties.[7]

Figure 2: The ladder of production model

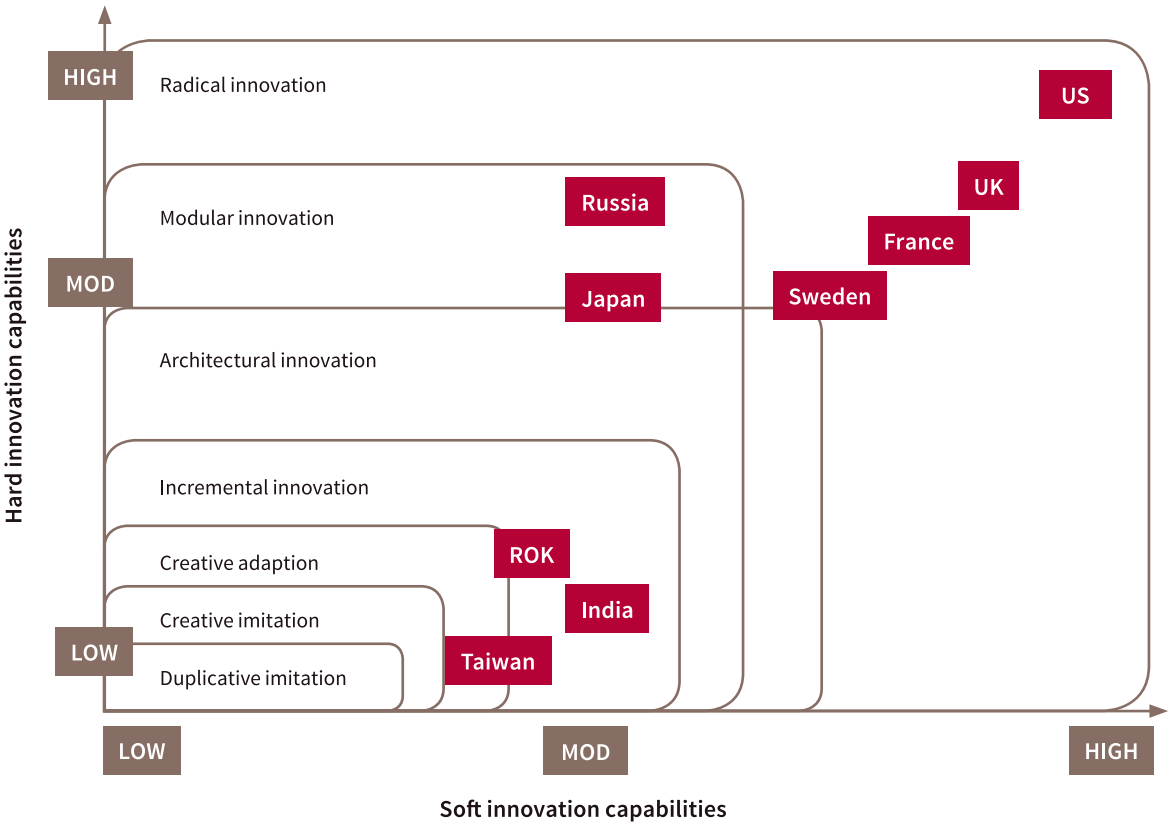


Source: Richard A Bitzinger, *Towards a brave new arms industry?*, Adelphi paper 356, International Institute for Strategic Studies / Oxford University Press, London, 2003

Related to the ladder of production is the 'innovation typology framework', as developed by Tai Ming Cheung and others, which starts with the key assumption that military innovation must be embedded in the political, economic, social, cultural and organisational factors that define the *capacity* of states to adopt, assimilate and adapt novel military technologies, doctrines and practices (Figure 3).[8] Subsequently, national defence industries are classified according to their capacity for innovation, from duplicative imitation through to creative imitation, creative adaptation, incremental innovation and so on, all the way up to higher forms of architectural innovation, modular innovation and, eventually, radical innovation.

The benefit of these two models is that they measure dynamic progress within a national defence-industrial base. They tell us not only where a country stands in the global hierarchy of armaments producers but *why*. The models measure not only countries' national defence-industrial bases relative to one another but also states' capacity for innovation and production. They also permit us to 'deconstruct' a country's national defence-industrial base and then analyse and assess each chunk of it independently; for example, a country's capacity for innovation in one sector (say, shipbuilding) might be stronger than its capacities in another (say, aerospace). Moreover, these models provide both an objective and a roadmap for progress, as it were, for arms-producing states that aspire to move up to higher tiers; in other words, if a country wants to increase its capacities for self-sufficient *and* technologically advanced armament production in a certain sector (or even overall), the evolutionary ladder-of-production model supplies a good gauge for development.

Figure 3: The innovative typology model



Source: Tai Ming Cheung, 'A typology of defense technological innovation and the place of the Chinese defense economy', in Tai Ming Cheung (ed.), *The rise of the Chinese defense economy: innovation potential, industrial performance, and regional comparisons*, University of California Institute on Global Conflict and Cooperation, San Diego, 2010

The challenge of niche arms producers and 'limited autarky'

But what about those weapons-producing states that *don't* aspire to high levels of autarky? It's generally thought that any arms-producing state worth its salt wants to become a *more* self-reliant producer of advanced armaments across a broad spectrum of industrial sectors (aerospace, naval, electronics and so on), or else it is judged to be somehow a failure as a weapons manufacturer. However, many states have either abandoned the idea of autarky or are content to achieve self-reliance in only a few defence sectors, making no effort in other sectors.

These states are generally designated as *niche suppliers*. They are arms producers that, either out of necessity or by design, have chosen to specialise in certain areas of armaments production and have subsequently jettisoned—or never pursued—other areas of arms manufacturing. They follow a defence-industrial strategy of 'limited autarky', mainly to preserve at least some capacity for indigenous production, partly for economic reasons (to preserve their existing defence-industrial bases or to protect jobs, their balance of payments or their arms exports) but particularly for reasons of 'strategic sovereignty'.

The case for strategic sovereignty emphasises the sizeable national security benefits that can accrue from even limited indigenous armaments production. To a certain extent, it's a hedge against foreign suppliers cutting off arms supplies. It also provides the state with some indigenous technological–industrial capabilities to develop customised solutions for national defence. Above all, even a modest indigenous arms-manufacturing capability can be powerfully reassuring; it can encourage a sense of empowerment and self-confidence, in that the state can domestically produce at least *something* that contributes to national security.

One well-known example was South Africa during the apartheid era. Denied foreign military equipment due to embargoes and sanctions, Pretoria was forced to fend for itself when it came to arms acquisitions. Consequently, most of South Africa's so-called indigenous weapons systems built during the 1960s, 1970s and 1980s were little more than reverse-engineered or updated versions of foreign weaponry already in the country's inventories. Self-sufficiency mainly meant adapting and modifying foreign designs and technologies—what one analyst has referred to as 'add-on' (upgrading) or 'add-up' (cobbling together) engineering.[9] For example, South Africa's Cheetah fighter jet program was essentially an upgrade of existing Mirage III airframes, whereas the indigenous Rooivalk attack helicopter was derived from pre-embargo French-supplied SA-330 Pumas.[10]

The usual arms-production models don't really account for the motives for such producers, since they generally assume that niche production is a 'second-best' or 'half a loaf' solution; in other words, countries do not desire 'limited autarky' but are forced to engage in it if the alternative is to have *no* arms-manufacturing capabilities at all. But is that necessarily true? Can nations be satisfied with possessing niche defence industries, to be content with *not* moving towards greater and expanded autarky? At the same time, is such a strategy worth the effort? In particular, can limited autarky and niche production advance a country's national security by supplying vital defence needs at an economically competitive price, especially if competitive foreign-sourced products are readily available (and perhaps cheaper than domestically produced systems)? And, just as importantly, is such a niche-oriented strategy sustainable over the long term?

A proposed model for assessing niche armaments production

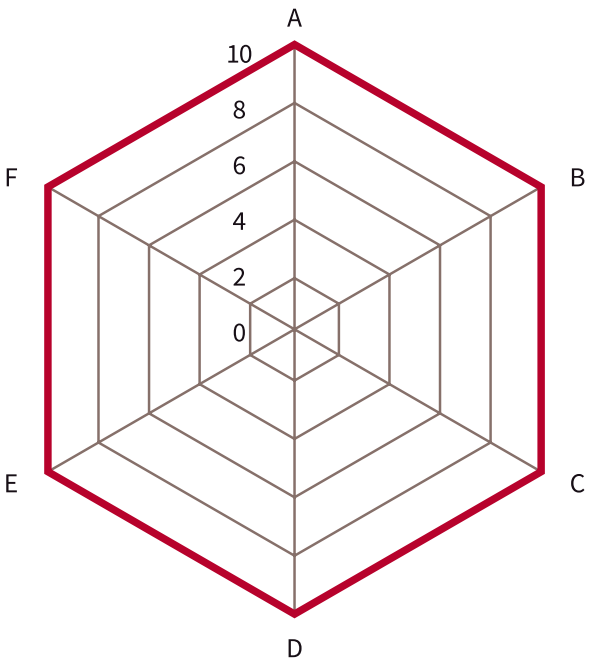
It might be feasible to construct a new model to explain decisions to engage in niche armaments production to achieve limited autarky. Consider a country that would like to produce arms if that production were both economically viable and strategically essential. Before it embarks on a limited-autarky defence-industrial strategy, it would probably have to consider the following factors:

- *The deemed strategic value of indigenous weapon systems to national defence requirements*. The state might be seeking to preserve its strategic sovereignty or to have the means to modify military systems to meet its unique challenges (basically, a hedging strategy). The higher the deemed value, the greater the desirability of an indigenously sourced system.
- *The cost-effectiveness of production*. The state must weigh the performance of indigenous weapon systems against their development and production costs, as well as against the performance and costs of competing foreign systems. High performance and low costs are desirable; low effectiveness and high costs are undesirable.
- *The exportability and revenue-earning potential of the indigenous system*. This is especially important for niche suppliers. The higher the export sales or the likelihood of them, the greater the appeal of indigenous production.
- *The availability of competing foreign alternatives*. The easier the availability, the lower the desirability of indigenous production.
- *The cost of foreign alternatives*. The lower the cost, the lower the desirability of indigenous production.

In a model incorporating these considerations, the desirability of limited autarky in a particular industrial sector or for a particular weapons systems can be measured as in Figure 4. In this case, the benefits of domestic production are high (high deemed strategic value, high performance, low cost, high probability of exports), while the benefits of imported systems are low (high costs and low availability).[11] Obviously, therefore, any decision to engage in indigenous armaments production would require the overall footprint on the graph (shown by the red line) to be as large as possible.

In many cases, such as small arms and munitions (Figure 5) and unmanned aerial vehicles (UAVs; Figure 6), even limited indigenous production might make sense. Additionally, if the cost-effectiveness and exportability factors are reasonably high for the domestic production of a particular piece of military equipment, those factors could outweigh disincentives in the form of the easy availability of alternatives on the international market. However, in some cases (such as the indigenous production of submarines by Australia), the negatives of indigenous production could be so great that they outweigh a high deemed strategic value (Figure 7).

Figure 4: The ideal environment



A = Performance of indigenous system

B = Deemed strategic value of indigenous system

C = Exportability of indigenous system

D = Cost of foreign-sourced system

E = Cost of acquiring system indigenously (inverse scale)

F = Availability of foreign-sourced system (inverse scale)

Figure 5: Small arms and munitions

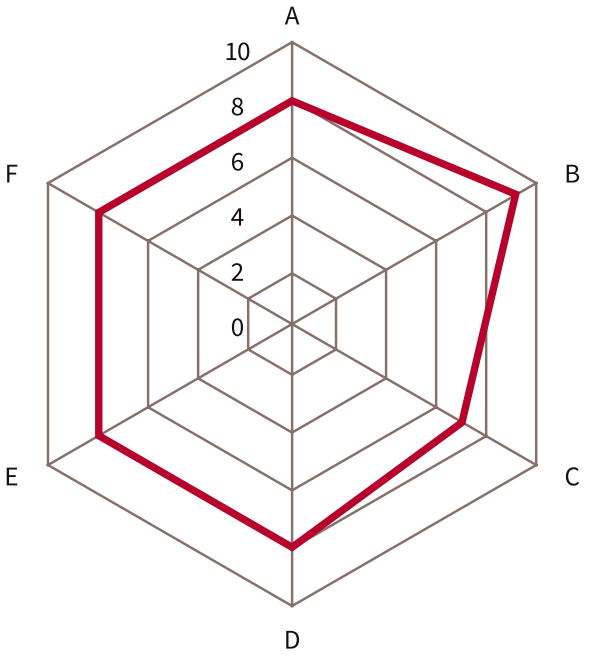


Figure 6: UAVs

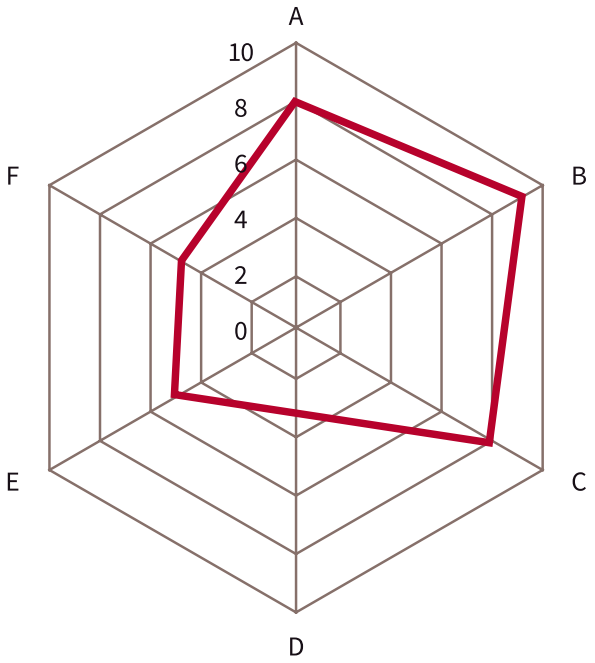
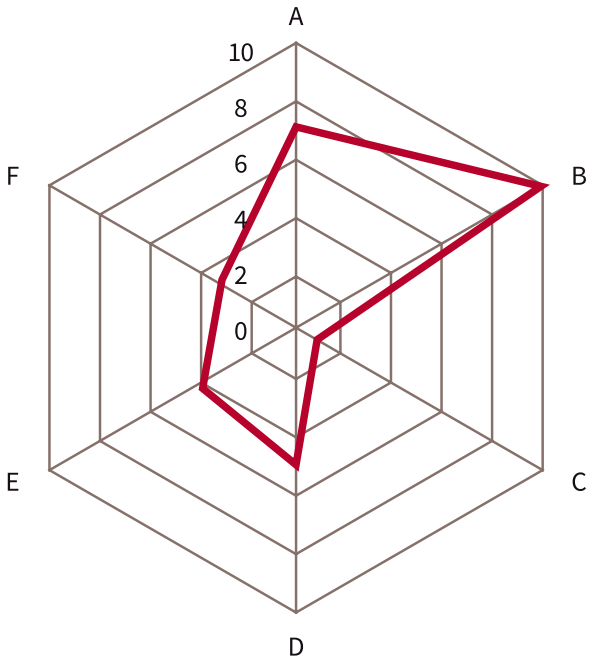


Figure 7: Collins-class replacement submarine



At the same time, the dynamic of such a model is highly susceptible to even small changes in the global arms market. A country's commitment to niche armaments production may be undermined when:

- foreign products suddenly come more available, and at lower prices (for example, as happened in South Africa after the UN arms embargo was lifted)
- the costs of domestic production rise, perhaps exorbitantly (Israel, in its efforts to develop the Lavi fighter jet)
- defence budgets fall, affecting domestic arms purchases (Argentina, Brazil and South Africa)
- initial niche advantages are undermined by foreign competition (Israel, with the global proliferation of UAVs)
- determinations of 'deemed strategic value' change (Israel's need to preserve a fighter jet manufacturing capability).

Such changes have occurred and continue to occur, which makes it problematic for many countries to justify niche armaments production. Above all, the hardest consideration to validate is 'deemed strategic value'. Because it's so subjective, it's the easiest to rationalise but also the hardest to defend. How does one effectively argue that a particular type of indigenous armaments production contributes significantly to national security? How, exactly, does it provide options or hedges that strengthen national defence? In some cases, the answers may be relatively easy:

- *Most likely yes, limited autarky makes strategic and economic sense*:
  - generic small arms and ammunition, where the local usage rate may be high and a domestic source helps to maintain supply (this is also an area where export potential is likely to be high)
  - maintenance, repair and overhaul capabilities, to ensure that there's a reliable source of skills to sustain, repair and upgrade weapons systems
  - systems engineering and integration skills, to make sure that pieces of military equipment work together (which is particularly important nowadays in C4ISR[12] architectures)
- *Most likely no, limited autarky is ill-advised*:
  - areas in which indigenous production might not contribute enough to national defence to justify the effort and cost, especially if foreign systems are easily available (or, paradoxically, so specialised that duplication would be inexcusably expensive)
  - areas in which the global arms market is particularly competitive (making it harder to export and easier to import): armoured vehicles, artillery systems and perhaps assault rifles (depending on the numbers likely to be acquired); high-end fighter aircraft (or at least their high-value components and subsystems, such as engines and avionics); most kinds of tactical missile systems; and large, highly advanced systems acquired in small numbers, such as Aegis air-defence systems and submarines.

Even so, evaluations of the costs and benefits of indigenous production could be much more ambiguous for a large swathe of weapons and other systems, such as:

- low- or medium-capability fighter aircraft (turboprop trainers, lightweight trainer jets)
- naval vessels (especially if production can be embedded in civilian industrial sectors)
- some types of missile systems (surface-to-surface, IR-guided air-to-air).

In such cases, costs can be difficult to predict, exports are possible but the competition severe, and performance may or may not be comparable to that of readily available foreign systems.

Implications for Australia

Decisions to engage in domestic armaments programs are almost always going to be contentious—even more so for smaller states with limited resources and for particularly expensive, high-end, technologically demanding projects. Often, the justifications for indigenous manufacture are highly subjective, while the potential benefits are exaggerated.

The 'deemed strategic value' of domestic production is open to wide-ranging interpretations of what constitutes a paramount and imperative defence requirement. In addition, nonstrategic and economic drivers (such as jobs), precedence (such as the preservation of existing defence-industrial capacities) and even emotional factors such as national pride are all powerful influences on rationales justifying indigenous arms production. At the same time, the potential for exports and other economic gains (such as the multiplier effects of local arms manufacturing) is almost always inflated, while costs are typically underestimated. Finally, one shouldn't be too quick to dismiss the idiosyncratic quirks of politics—especially in democracies—that often put pressure on governments to pursue indigenous arms procurement.

For Australia, this has been nowhere more apparent than in the case of the Collins-class submarine replacement program. The next-generation submarine will be the most expensive military procurement effort in Australian history, costing anywhere from $18 billion to $40 billion for 12 boats.[13] The pressure to construct these submarines domestically has been tremendous, but the costs and benefits of such an undertaking are largely unknown. As Figure 7 shows, while the strategic value of producing the submarines indigenously may be high, most of the other benefits of domestic manufacture—such as performance, keeping production costs down and export potential—are likely to be quite low. Any submarine meeting Australia's range and endurance requirements is likely to be quite different from any 'readily available' system, and it will therefore require a dedicated R&D and construction program. Furthermore, transferring design and production engineering into an Australian shipyard (as opposed to taking advantage of a foreign design house's already well-established end-to-end processes) adds an additional layer of risk. Consequently, such a high-end, ambitious program could fill up very little of the area of the graph.

In sum, decisions to produce arms—even to engage in niche production—need to be continually evaluated and re-evaluated for their costs and benefits. Even if a nation only wants to pursue limited autarky, that can still be a high-risk, low-reward undertaking.

Once a country has put itself on a particular path of arms manufacturing, it may have to endure many painful setbacks before it decides that the goal is no longer worth the effort. It would be preferable not to learn that lesson the hard way.

Notes

1 Ralph Sanders, *Arms industries: new suppliers and regional security*, NDU Press, Washington DC, 1990, pp. 11–17; Michael Brzoska, Thomas Ohlson, 'Conclusions', in Michael Brzoska, Thomas Ohlson (eds), *Arms production in the Third World 1971–1985* (pp. 279–280), Oxford University Press, Oxford, 1987.

2 Susan Willett, 'East Asia's changing defense industry', *Survival*, Autumn 1997, p. 114; Tim Huxley, Susan Willett, *Arming East Asia*, Oxford University Press, Oxford, July 1999, p. 51.

3 James Elliot, Ezio Bonsignore, 'Asia's "new" aerospace industry: at the turning point?', *Military Technology*, February 1998, p. 31; Dean Cheng, Michael W Chinworth, 'The teeth of the little tigers: offsets, defense production and economic development in South Korea and Taiwan', in Stephen Martin (ed.), *The economics of offsets: defense procurement and countertrade* (pp. 245–298), Harwood, London, 1996, pp. 245–246.

4 See Stephanie G Neuman, 'Industrial stratification and Third World military industries', *International Organization*, Winter 1984, pp. 191–197.

5 Richard A Bitzinger, *Comparing Asian and global defense industry trends and the Chinese defense industry*, PowerPoint briefing, drafted 23 April 2012. For further elaboration, see Richard A Bitzinger, Michael Raska, Collin Koh Swee Lean, Kelvin Wong Ka Weng, 'Locating China's place in the global defense economy', in Tai Ming Cheung (ed.), *Forging China's military might: a new framework for assessing innovation*, Johns Hopkins University Press, Baltimore, 2013. See also Richard A Bitzinger, *Towards a brave new arms industry?*, Adelphi paper 356, International Institute for Strategic Studies / Oxford University Press, London, 2003, pp. 6–7.

6 Richard A Bitzinger, 'China's defense technology and industrial base in a regional context: comparing Chinese defense industrialization to experiences of other Asian–Pacific Nations', *Journal of Strategic Studies*, Summer 2011, pp. 133–140.

7 Bitzinger, *Towards a brave new arms industry?*, p. 18.

8 Tai Ming Cheung, 'A typology of defense technological innovation and the place of the Chinese defense economy', in Tai Ming Cheung (ed.), *The rise of the Chinese defense economy: innovation potential, industrial performance, and regional comparisons*, University of California Institute on Global Conflict and Cooperation, San Diego, 2010.

9 Michael Brzoska, 'South Africa: evading the embargo', in Michael Brzoska, Thomas Ohlson (eds.), *Arms production in the Third World 1971–1985*, p. 206.

10 Signe Landgren, *Embargo disimplemented: South Africa's military industry*, Oxford University Press, Oxford, 1989, pp. 75–77.

11 Factors E and F are measured on an inverse scale (as opposed to factors A, B, C and D); that is, the *higher* the score, the *lower* of the cost of an indigenous system (factor E), and the *less* available a foreign system (factor F).

12 C4ISR = command, control, communications, computers, intelligence, surveillance and reconnaissance.

13 David Wroe, 'Australian-made submarines substantially cheaper than government suggests', *Sydney Morning Herald*, 20 November 2014.

Important disclaimer

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Richard A Bitzinger is a Senior Fellow and Coordinator of the Military Transformations Program at the S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University (Singapore), where his work focuses on security and defence issues relating to the Asia–Pacific region, including military modernisation and force transformation, regional defence industries and local armaments production and weapons proliferation. Mr Bitzinger has written several monographs and book chapters, and his articles have appeared in such journals as *International Security*, *Orbis*, *China Quarterly* and *Survival.* He is the author of *Towards a brave new arms industry?* (Oxford University Press, 2003); 'Come the revolution: transforming the Asia–Pacific's militaries', *Naval War College Review* (Fall 2005); and 'Military modernization in the Asia–Pacific: assessing new capabilities', *Asia's Rising Power* (National Bureau of Asian Research, 2010). He is also the editor of *The modern defense industry: political, economic and technological issues* (Praeger, 2009).

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