AFRICAN SECURITY REVIEW
2025, VOL. 34, NO. 2, 168–187
https://doi.org/10.1080/10246029.2024.2429392

Routledge
Taylor & Francis Group

OPEN ACCESS Check for updates

The South African Defence industry: A contemporary comparative analysis of its second tier nature

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ABSTRACT
The South African Defence Industry has undergone several changes over the past decades, with the end of Apartheid seeing the industry transform itself from a practically self-sufficient one to a smaller one, embedded into foreign firms and achieving international success. However, the recent past has not been kind to the industry, and the calls for government support appear unheeded. By performing an extended literature review, this research attempts to determine whether the second-tier label given to the South African Defence Industry is accurate and if the nation's changes have affected this categorisation. Further, by comparing its characteristics to those of similar nations' and exploring African defence industries, it is effectively a contemporary examination of South Africa's place in the international arms industry.

ARTICLE HISTORY
Received 13 September 2024
Accepted 8 November 2024

KEYWORDS
South African Defence Industry; defence industry categorisation; second tier nations; military spending; globalisation; defence innovation

Introduction

The South African Defence Industry has a long and colourful history. After modest post-war development, political isolation during the Apartheid years saw the industry grow into a successful, virtually self-sufficient defence industry that adequately catered to the distinctive requirements of the South African Defence Force (SADF). From helicopters and armoured vehicles to fighter aircraft and the means to adequately support these systems, South Africa could compare well with the best-equipped militaries in the world. The end of Apartheid and the cessation of conflicts in neighbouring states brought about a considerable downsizing of the South African military machine. However, offshoots from the Strategic Defence Package (SDP) resulted in local defence companies seeing solid international sales well into the 2010s, as they forged long-lasting professional relationships with large defence firms and opened up the global defence market.[1] These military capabilities developed by the South African Defence Industry (SADI) through the years have made it a Tier II defence industry.[2]

However, the last two decades have not been kind to the South African defence fraternity. Scholarly articles and the media have offered critical commentary regarding the state of the industry, calling for government support to ensure the survival of the defence industrial base.[3] The relationship between the SANDF and the defence industry has declined as the proving of

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systems using SANDF platforms and/or test ranges has not endured, thereby reducing foreign customers' confidence in the products and solutions offered.[4] Academics conclude that defence-industrial stagnation has occurred, exacerbated by corruption, unethical sales, and government mismanagement.[5] High-ranking officials within the defence sphere also assert that the industry's decline will harm other sectors within South Africa.[6]

Many academic publications chart this change and offer reasons for the transformation, along with possible resolutions.[7] The research objective of this piece, however, is to determine whether the second-tier label given to the SADI is indeed accurate and how the changes in South Africa have affected this categorisation (if at all). Further, by reflecting on the characteristics of other, similar nations, it is effectively a contemporary examination of South Africa's place in the international arms industry.

Background: Defence industry categorisation

The bedrock on which this research is based is Richard Bitzinger's defence industry classification, which has been discussed and expanded upon by several authors,[8] where the characteristics of a sustainable defence industry are described.[9] Regarding the definition of a defence industry, the 2015 South African Defence Review description is considered apt:

> Comprising companies (both public and private) that are primarily concerned with the design, development, manufacture, production or support of weapons, munitions, pyrotechnics, equipment systems and other materiel for the Defence Force or for export; divisions of companies in other sectors that are so engaged; and companies that are major sub-contractors or component suppliers to such activities.[10]

A sustainable defence industry falls into one of three tiers. Tier I comprises industries that can fully support their militaries' basic needs whilst achieving global success. There is little or no government involvement in its budget or protection policies, and the industry is a critical innovator in arms technologies. Tier II nations require government support and can only provide for the basic military needs of their country. Here, the defence industry has adapted and modified technology to produce defence products from arms suppliers. Tier III sees the defence industry copying other countries' arms equipment and producing the equipment without any further improvements. Due to a limited budget and dependency on the government, these industries can only assist in satisfying the country's basic military needs.[11]

In a related treatise, Bitzinger expands on second-tier nations slightly by classifying them into three sub-categories that define their arms-producing capabilities. The first is technologically advanced industrialised countries that produce a limited array of state-of-the-art weapons systems, with Japan being a prime example. Newly industrialised economies containing modest but growing defence industrial complexes come next; examples include Indonesia, Singapore, South Korea, and Taiwan. Finally, there are the rising great powers with large, broad-based defence industries but that are still lacking in certain areas of indigenous Research and Development (R&D) and industrial capacities when it comes to developing and producing highly sophisticated conventional arms (examples are China and India).[12]

Approach

Using the defence industry classification as a foundation, a multi-dimensional approach comprising several systems and metrics has been used to compare the three tiers' key

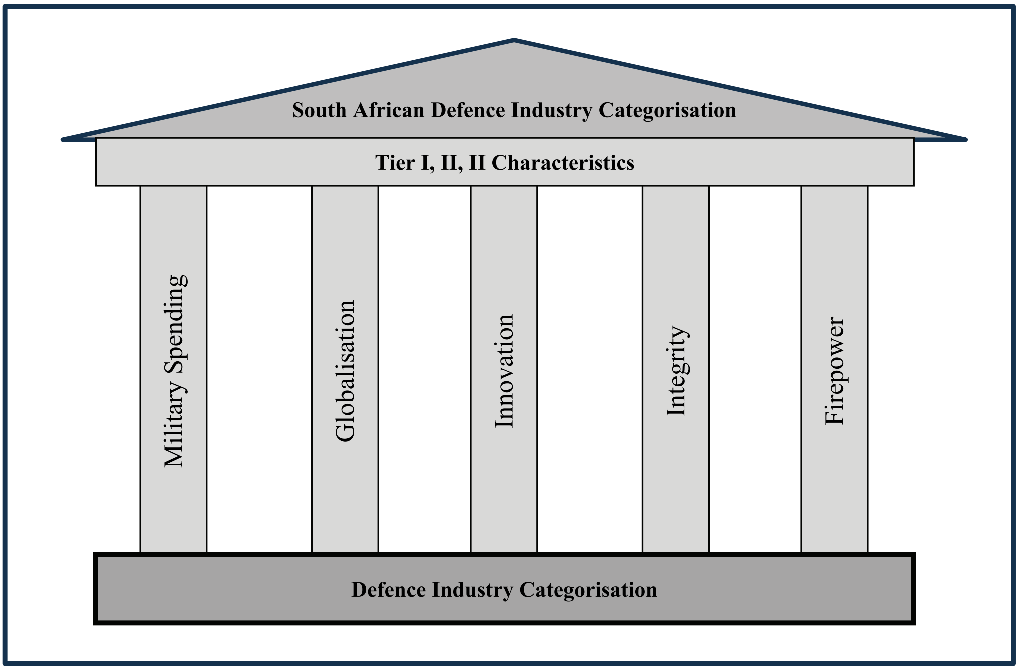

Figure 1. An illustration of the approach adopted. Source: The authors.

characteristics. Figure 1 illustrates the concept employed, with each dimension represented by the pillars of Military Spending, Globalisation, Innovation, Integrity, and Firepower. While there are quantitative elements within each dimension, the approach is essentially qualitative. This methodology is supplemented by an extended review of scientific publications (in the public domain) to determine how specific defence industries of the world ensure resilience and success. To appropriately examine the South African case, it is pragmatic to concentrate more on Tier II nations and place South Africa within the African context.

Military spending

The annually updated Stockholm International Peace Research Institute's (SIPRI) Military Expenditure Database presents an independent and reliable source of information regarding worldwide military expenditure over a 70 year period.[13]

Examining the SIPRI data, it is observed that military spending in every region has increased since the early 1990s. There was a slight dip in the late nineties, quite possibly due to the inertia of the Cold War's demise, but a steady year-on-year increase is apparent since then. Every region exhibits this trend, with North America in the lead by far, followed by Asia, Oceania, Europe, and the Middle East. Africa trails with very low levels.

There has been an increase in international arms transfers over the last decade. Asia and Oceania dominate arms imports, with the Middle East following closely. India has been leading the pack for several years but has been overtaken by Qatar in 2022. Regarding military expenditure by country as a percentage of Gross Domestic Product (GDP) in 2022, the Middle East dominates, with a prime example being Saudi Arabia at 7.42% and Qatar at 6.96%. South Africa's expenditure in 2022 was 0.74%, down from 0.81% in 2021. Decoupled from a nation's military expenditure, the data on arms-producing companies provides insight regarding defence industry capabilities; the US and Europe (predominantly the United Kingdom, France and Germany) make up the leading two-thirds; Asia and Oceania follow, with China leading the pack with eight companies. South Africa is the first African country on the list, at number twenty-six; however, there is a notable year-on-year decrease in South African defence exports.[14]

Globalisation

While reflections regarding the defence industry rest upon the nation's foundation, it is also necessary to consider a nation in the context of globalisation, with due consideration given to the concept of global success within the defence industry categorisation. A useful, independent resource to aid in this exploration is the Washington International Trade Association's (WITA) 2020 Globalization Report.

European countries lead the pack, with South Africa ranked 37 and grouped with nations such as Turkey, South Korea, Israel and Indonesia. The report states that among the major emerging markets, China, Nigeria, Brazil, Argentina, and India show the lowest level of international integration (these nations rank from 41 through to 45, respectively). One of the reasons for this is that their capital and financial markets are much less internationally integrated than those of most industrialised countries.[15] Therefore, while China may be, by far, the world's largest exporter, the country fares relatively poorly in the globalisation index.[16]

Considering the 'Economy', 'Social' and 'Political' sub-indices, South Africa has the same general ranking. The report bleakly states that South Africa's post-Apartheid solid globalisation surge has not been maintained into the new millennium. The last decade has seen the sub-indices remain relatively constant, albeit with a decline in the 'Economy' and 'Social' sub-indices.[17]

Innovation

As shown in the literature review below, a key theme that needs to be considererd in defence industry analysis is that of innovation. Therefore, the 2023 edition of the Global Innovation Index (GII), a World Intellectual Property Organization (WIPO), Cornell University and INSEAD (Institut Européen d'Administration des Affaires) joint effort, is a valuable resource for evaluating a nation's innovation capabilities.[18]

Regarding the GII, South Africa is ranked at 59 for the year 2023. Countries within the same general zone include the Philippines, Mexico and Indonesia. When considering other nations similar to South Africa from a Globalisation perspective, Turkey and India rank at 39 and 40, respectively, while South Korea is at number 10. From a continental viewpoint, South Africa leads the pack and, when considering innovation performance for an 'Upper Middle-Income' nation, South Africa is classed as 'above expectations for the level of development'. High-income economies are all European but for South Korea and Singapore. China, Malaysia, Turkey, Brazil and Serbia join South Africa in the 'Upper Middle-Income' economy category.[19]

Integrity

Another worthy index is Transparency International's 'Defence Companies Index 2020 (on Anti-Corruption and Corporate Transparency)' and 'Government Defence Integrity/

Anti-Corruption Index'. With corruption being a rather negative aspect (no matter what sector), it should form an input towards how South Africa compares to other nations.[20] Further, as stated in the introduction, corruption has been a thorn in South African Defence Industry's (SADI) side for many years.

The only South African company on the former list (Denel) falls in the last band: 'Very Low Commitment to Anti-Corruption and Transparency', the highest risk category.[21] The latter report places South Africa in Band C, the Moderate category for corruption in the defence and security sector and, while complimentary regarding the robust nature of financial and personnel management processes, states that 'Institutional resilience to corruption is modest in South Africa's defence sector. However, poor oversight of policy-making and procurement processes coupled with limited transparency and access to information heighten corruption risk'. Similar nations to South Africa (as identified in the Globalization Report 2020) all range from bands C to E.[22]

Firepower

The Global Firepower Index ranks the potential war-fighting capability of 145 countries. The 2024 index sees South Africa ranked at 33, with the highest-ranked African countries being Egypt (15) and Algeria (26). However, James Kerr critically analyses South Africa's place in the index and concludes that the ranking is based on 'equipment numbers, not equipment serviceability'; the actual capability is not accurately quantified, which would, in turn, point to the skills and know-how inherent in the SADI. South Africa would, therefore, seem to be 'fighting above its weight class in the international arena'. The very good ranking does, however, represent an opportunity for the South African government that should be recognised and acted upon.[23]

Comparison of Tier I, Tier II and Tier III key characteristics

Table 1 summarises the preceding discussion, with the caveat that the 'Defence Expenditure' data does not necessarily reflect the capability of a nation's defence industry, with China and India being prime examples (in fact, an investigation into the turnover of a nation's defence industry compared to government military spending is deemed worthy of further study). Therefore, the 'Characteristics' column is of most importance when categorising countries.

The first tier

As reflected in Table 1, Tier I nations invest heavily in defence, emphasising dynamic innovation capabilities, leading to global success with little or no support from their respective governments. Their approaches offer guidance to those that wish to ascend the categorisation ladder.

Roni and Setiawan state that resilient defence industries, like those of the West, allow a country not to become too dependent on foreign military products. Such an efficient and effective defence industry can have strategic influence that contributes to the nation's standing in the world arena from both political and military perspectives and can play an important role in the state's survival.[24] Scortecci dubs the US defence industry 'advanced and integrated',[25] while other scholars remark that the onset of globalisation means that the US would have to change how they conduct defence-related business, especially regarding

Table 1. Sustainable defence industry key characteristics.

Tier	Characteristics	Defence Expenditure (2022 US$ billion)	Defence Expenditure (% of GDP)	Countries (select examples)
I	• Innovation Index: High ○ Critical Innovator ○ Technologically Advanced • Defence Autarky: ○ Government Support: Little/none ○ Military Support: Total ○ Success: Global ○ Globalisation Index: High • Integrity Index: Very Low/Low/Moderate	> 40 USA: 778 (China: 252) Others < 100	1–8	• France • Germany • Italy • UK • USA • (Western Europe)
II	• Innovation Index: Mid-level ○ Adaptor and Modifier ○ Newly industrialised • Defence Autarky: ○ Government Support: Moderately dependent ○ Military Support: Basic ○ Success: Modest ○ Globalisation Index: Mid-level • Integrity Index: Low/Moderate	<40	1–3	• Brazil • China • India • Indonesia • Iran • Israel • Japan • Poland • Portugal • Serbia • South Africa • South Korea • Switzerland • Turkey
III	• Innovation Index: Low ○ Copier and Reproducer ○ Lacking R&D, industrial capability • Defence Autarky: ○ Government Support: Highly dependent ○ Military Support: Assists for basic support ○ Success: Minimal/non-existent ○ Globalisation Index: Low • Integrity Index: High/Very High/Critical	< 10	< 2	• Algeria • Cameroon • Egypt • Morocco • Nigeria

Source: Authors' compilation (Roni et al., 'Sustainable Defense Industries'; SIPRI; Gopaul et al., 'South African Defence Industry'; Sachs et al., 'Globalization Report; Dutta et al., 'Global Innovation Index 2023'; Cilliers, 'A Brave New South African Defence Industry'.).

R&D expenditure and innovation.[26] It is worth noting that it is claimed that China is 'catching up' with the US.[27]

Scortecci further asserts that innovation is fundamental for defence industries to evolve,[28] and that competition fuels innovation, which Palavenis echoes.[29] Further, defence innovation happens within a complex industry.[30] Fiott, in analysing the European state of affairs, declares that cutting-edge innovation is increasingly emerging out of the commercial sector, which reflects the thoughts of Gouré and McGinn concerning the US, but the paradox is that only defence firms and governments can align civil technologies to defence end-user needs.[31]

The French and British defence industries have successfully adapted their innovation and R&D capabilities since the end of the Cold War. Defence companies mobilised and redeployed their technological skills proactively to remain key players in the national innovation system, maintaining their research capabilities and developing new innovative strategies and models, considering both civil and military markets.[32]

The second tier

Defence autarky and industry resilience

Bitzinger relates techno-nationalism to autarky, where indigenous arms production serves a larger, more ambitious national interest: securing and advancing a nation's geopolitical status in a regional or global system. Techno-nationalism is also related to economic growth and innovation. This techno-nationalist impulse has become endemic to Asia since many Asian nations have become increasingly capable of supplying themselves with multiple means of warfare. Of particular interest is South Korea, which has for decades pursued parallel strategies of 'security and development' to build up its heavy industry and high-technology sectors as it strove for self-sufficiency in arms production. This has been favourably compared to Brazil's 'Security and Development' policy. South Korea also expects to expand its defence exports greatly.[33]

Japanese techno-nationalism stresses a high degree of civil-military integration, entailing a dual-use approach, deliberately spreading advanced technologies beyond their original function and intent. Similar trends can be seen in Indonesia and India, where advancing the country's overall technology and industrial base is seen as a product of the local defence industrial base. China however, while possessing features of techno-nationalism similar to those of Japan and South Korea, is seen as a 're-innovator'.[34]

Also channelling techno-nationalism, Turkey sees investment in the defence industry as a means to become one of the world's most technologically developed countries. According to Seren, as of 2021, there were approximately 225 defence-related companies and 1500 defence-related products within Turkey. Other sectors seem to benefit directly or indirectly from the investment in the defence industry.[35] Many quantitative studies found this to be the case.[36] Bayram reports that fourteen African states have imported Turkish weapons systems,[37] with the result that commentators have labelled Turkey a 'rising power'.[38]

A comparative analysis of defence industry policy development between Brazil and Indonesia reveals that in both cases, the defence industry focus, although initially aimed at the military, changed into 'multi-faceted roles that extend beyond defence' and is seen as an economic driver and a 'centrifugal force for growth'. Brazil's industry policy development strategies include technology transfer programmes, protecting defence industry products to ensure domestic use, privatisation, establishing institutions for fostering and managing the defence industry and making defence industrialisation an essential part of national industrialisation. The result is a developed industry that can compete in the export market. Indonesia, however, does not yet have complete technological independence and, due in large part to improper application of defence industrial policies, is found wanting in many aspects.[39]

When considering security of supply, Marc DeVore states that this has long been the primary justification for states to develop domestic defence industries. However, echoing Bitzinger, his counterpoint is that technological changes render security of supply unattainable for all but the most largest states. Military adaptation, DeVore argues, may allow domestic arms industries to enhance states' abilities to adapt to battlefield challenges. Engineers and scientists possess skills and experience enabling collaboration with domestic armed forces to develop technological solutions – this is of high strategic value and only obtainable through domestic defence industries' human capital. Foreign firms cannot provide this. Inherently present in Israel and Serbia and demonstrated during South Africa's isolation years,[40] Fiott has also stated this characteristic concerning the European defence industry.[41]

Israel's success is also due to its relatively liberal approach to arms exports, resulting in a dynamic, domestically owned defence industrial base.[42] DeVore maintains that the Swedish case is similar, with the country's leadership concluding in the early 2000s that defence-industrial self-sufficiency was no longer feasible or desirable. However, liberal defence export policies ensure that expertise and defence industry capacity remain active. Sweden's Cold War policy of neutrality saw a critical drive for autonomy and self-sufficiency, resulting in large amounts of funding being allocated to defence R&D and production capabilities. As with many other nations in the early 1990s, the defence budget shrunk, and many Swedish defence companies became embedded with international companies (of note is Saab in South Africa). This resulted in Sweden becoming one of the world's major arms suppliers.[43] The local effect, claims Ikegami, was that a 'national' defence industry has become irrelevant, as the focus has shifted to arms exports. However, the author acknowledges that this internationalism drive was an essential post-Cold War business strategy to ensure the survival of defence companies.[44]

Regarding armed forces size, military expenditure and arms imports, India surpasses most other nations by a significant margin.[45] The large import factor is mainly due to the local non-availability of modern, advanced weapon systems.[46] Despite having a solid defence industrial base, the long-cherished goal of achieving self-sufficiency in defence remains elusive. Das is adamant that, being one of the fastest growing economies in the world and a significant regional power, India cannot afford to import defence material – defence autarky is 'absolutely necessary', and asserts that the country can earn substantially from defence exports.[47] The nation's 'Make in India' concept encourages companies to manufacture their products in India; boosting the local defence industry will result in export growth. While the idea is noble, Mittal et al. conclude that if success is to be achieved, it should first satisfy the domestic market.[48]

Iran, a significant player in the Middle East, is considered a mysterious and misunderstood country, with very little information regarding the defence industry being publicly available. Aided by foreign technological know-how, the foundations of an indigenous defence industry were established in the 1970s. The Shah believed that investment in the military would boost the nation's economic power.[49] Iran also enjoyed a good relationship with Apartheid South Africa during the Shah's reign in the 1970s.[50]

Post-revolution, out of necessity, the primarily state-owned fledgling defence industry was forced to meet the needs of the military – the result was a capability to maintain the legacy equipment in service and perform various reverse engineering functions. Spare parts manufacturing and designing and developing various new systems enabled the industry to achieve high self-sufficiency levels.[51] A South African parallel is immediately apparent here.

The Iranian defence industry claims it can more than adequately satisfy the wide-ranging requirements of the different arms of military service. It has recently declared intentions to increase exports beyond its major customers (Iraq, Syria and insurgent organisations). However, Czulda declares that the information regarding the industry's capabilities and accomplishments is propaganda designed by government officials and the media to deceive the international community. He believes the country lacks the R&D and production capabilities needed for state-of-the-art military systems. However, real achievements do appear to be in the realms of Unmanned Aerial Vehicles (UAVs) and air defence.[52]

While there is a general lack of robust information regarding defence industrial development within Arab states, there does appear to be a concerted effort, especially in the Persian Gulf, to reduce dependency on foreign arms suppliers and to develop indigenous defence technological capabilities (as discussed above, some of the largest defence spenders in the world are, in fact, from the Persian Gulf). Offset programmes are commonplace, but the results have been mixed. The United Arab Emirates (UAE) and Saudi Arabia have entered agreements with various international firms to boost their local capabilities, with the UAE enjoying a close relationship with South Africa in UAV development. The UAE's success appears to be due to the acquisition of foreign firms. The long-term aim would be to ensure autarky with an element of techno-nationalism, with pride also being an essential aspect for Arab nations.[53] What must also be noted is that there have been endeavours in the past (since the 1960s) to bolster local defence industrial development, but with little success.[54]

In the final analysis, Bitzinger cautions that indigenous defence industries are highly prone to failure; one reason is that local defence R&D bases still possess limited capacities for independent innovation. Significant initial dependencies on foreign technology inputs still require countries to make sufficient investments in their indigenous R&D bases to innovate successfully. Therefore, the techno-nationalist strategy results in considerable effort and resources being wasted on 'reinventing the wheel' when the very same capabilities are widely and more cheaply available from other countries.[55]

Innovation and research and development

On the subject of technological advancement, Bitzinger quotes David Edgerton, who states that 'techno-nationalism assumes that the key unit of analysis for the study of technology is the nation: nations are the units that innovate, that have R&D budgets and cultures of innovation, that diffuse and use technology'.[56] Techno-nationalists believe that nations' success depends on how well they do this. Bitzinger concludes that the technology, however, acquired, is assimilated and circulated throughout the national technology base and is further 'processed' with indigenous R&D, resulting in technology being changed and advanced sufficiently so that it is something new and innovative.[57] This commentary, whilst embedded within the realm of second-tier nations, reflects the posture of the Tier I countries discussed above.

Consider the Triple-Helix model (university–industry–government relationships); Etzkowitz and de Mello discuss the emergence of the model in Brazil, initiated during the military government's rule, where substantial resources were allocated to science and technology R&D. Post-military rule (1984) saw the promotion of innovation initiatives, investment in science and technology and collaboration between universities and the state government, which resulted in the creation of an innovation culture. One of the profound success stories of these investments is Embraer, founded in 1969.[58]

In their study of the Portuguese defence industry, Simões et al. conclude that with practical application of the Triple Helix model, the defence industry of a small country can gain and share significant technological competencies. This can be seen as a framework for similar-sized countries. The authors maintain that the model can be a leading source of innovative technology, entailing new partnerships between public and private actors.[59]

Reflecting on the characteristics in Table 1, the authors echo the sentiment that innovation has prominence within the defence industries of the West. In China, the techno-nationalist model of imitating technology emphasises the role of the state and downplays market forces when it comes to developing local arms industries, but this is being challenged with the gradual shift from imitation to indigenous innovation, in the hope of catching up with the West. They recommend accelerating indigenous innovation capabilities and encouraging involvement in civil-military integration activities while interfacing with global economic networks.[60] This analysis is a prime example of the awareness that certain non-first-tier nations possess regarding the requirements to move up the defence industry categorisation ladder.

In a timeline very much in line with South Africa, a recent Polish Strategic Defence Review was promulgated to set out a vision of tasks, capabilities and organisation of the Polish armed forces for the year 2032. To achieve this, the Polish government has recognised the need to 're-industrialise' and that the defence industry is the 'key to sustaining economic growth'. Government policy indicates that Polish defence companies can generate 'technological impulses' for developing dual-use technologies whilst also having significant potential for innovations, leading to supporting the general industrial base in the nation. The government recognises that the aforementioned concepts, coupled with cooperation with global prime contractors, should create opportunities for the export of innovative solutions.[61]

The shifts in the global arms market in the 1990s led to a temporary slowdown of the Swiss defence industry, which prompted the government to revise its defence strategies – mechanisms were introduced to support the domestic defence industry and boost their competitiveness. These included domestic procurement, offset, international cooperation, applied research, promotion of innovation, an export control policy and expansion into civilian and dual-use technology production. Palavenis asserts that 'it is expected that competition among arms suppliers would drive innovation' and that the government's efforts have more than likely contributed to the subsequent revitalisation of the Swiss defence industry.[62]

As previously alluded to, India's large defence industry is plagued by a poor innovation foundation. Mittal et al. conclude that there has been 'highly unsatisfactory' R&D performance within India, 'belying all hopes of developing indigenous competence' and catching up with global leaders.[63] Kishore maintains that minuscule investment in defence R&D, skill deficiency, and poor production capacity do not align with the country's strategic aspiration. He states that focussing on innovation, collaborative development and dual-use technologies are keys to success.[64] India, therefore, from academic and government perspectives, also seems aware of what needs to be achieved for the nation to rise to the top of the categorisation of the defence industry.

Similar to India, Bağcı and Kurç point to the weakness of Turkish innovation capabilities; they argue that this factor has a direct impact on being internationally competitive and may curtail the country's self-sufficiency efforts,[65] which justifies the nation's ranking as second tier. Turkey nevertheless seems to be forging ahead to achieve autarky, supported by local skills, dual-use technologies and a healthy export outlook.[66] Exports look especially promising concerning UAVs.[67] The recent (February 2024) inaugural flight of Turkey's fifth-generation fighter aircraft exemplifies innovation and technological progress.[68]

Ghazinoory and Vaziri argue that systems engineering principles, fostering innovation, dual-use technologies, and a solid relationship with academia has made the strategic self-sufficiency goal somewhat achievable for the Iranian defence industry. They claim the defence industry's success is founded on being kept separate and unique from other industries; using open innovation within highly motivated engineering teams encourages industrial entrepreneurship, creating technological niches.[69] This is somewhat supported by the relatively high defence budget, fuelled by oil sales, which seems to have a positive overall effect on the Iranian economy.[70] Iran, therefore, strives for a Tier I ranking.

Considering thirteen high, medium and low-income countries in the Middle East, Yildirim et al. draw similar conclusions regarding technological advancement, with the defence sector being more productive than the civilian sector because they use more advanced technologies.[71] A good example is Israel, which maintains a high-tech defence industrial base capable of providing technologies critical to its strategic sovereignty, able to innovatively design and develop almost any weapon system. Israel reformed its defence procurement processes, prioritised R&D, and encouraged industry to specialise, thereby competing internationally.[72] Iran's focus on innovation and drive towards self-sufficiency has created niche capabilities in terms of missile and UAV technologies. These can expand due to enough resources and, if the claims are indeed true, with assistance from Russia and North Korea.[73]

Gaub and Stanley-Lockman state that innovation ultimately drives the success of defence industries. For this reason, Tier I defence industries place large amounts of funding and emphasis on this domain. However, the authors acknowledge that innovation to achieve technological advancement results in deterrence, but this may not be the case in the Arab world, where 'good enough' weapons will be used in conflict.[74] Further, Roni and Setiawan remark that the needs of the country where the industry is based are a priority and that innovation is vital. They also assert that defence industries and governments cannot be separated if governments are the primary stakeholders in those industries.[75]

The third tier

From reliance to domestic technological competence

With limited information available regarding most third-tier nations, this part of the discussion focusses on Africa; as mentioned above, South Africa would need to be placed within the context of African defence industries. Independent research carried out by research group IPIS confirms the 'relatively unknown' nature of the African defence industry in general. Mention is also made of the intent of many African countries to develop their defence industry capabilities, yet cannot do so. The IPIS website nevertheless attempts to list all the known capabilities on the continent,[76] and there are a number of scientific publications in the public domain.

Algeria possesses the most potent military capabilities in the Maghreb region of Africa, investing handsomely in importing equipment from Russia, the US, and various European nations. The defence industry is still fledgling, manufacturing Russian and Chinese small arms. The last decade has seen a steady increase in defence industrial collaboration with several countries, with offset and technology transfer programmes expected to be part of procuring several state-of-the-art platforms.[77] Dekhakhena states that the defence industry would need more attention if the nation wants to play a more prominent role in the region.[78] This is echoed by Němečková et al., who assert that relying primarily on imports should be secondary to developing domestic defence manufacturing expertise.[79]

Algeria's neighbour, Morocco, has recently raised its budget to form partnerships with international defence firms to create a local defence manufacturing capability.[80] There has been heavy reliance on US imports, which may be coupled with the need to 'attain regional military supremacy'.[81] Joint ventures with European companies are reportedly being pursued, and Saudi Arabia is believed to be investing in the local defence industry.[82]

The Egyptian defence budget saw a massive reduction after the Cold War; the government nevertheless supported the defence industry in manufacturing goods for the civilian market, maintaining their budgets and expanding. During the last decade, political pressure has mounted to reduce dependency on the US and become more self-sufficient, whilst also partnering with European organisations. However, Egypt continues to rely heavily on arms imports, much more than its own production, with Russia being a significant supplier.[83]

Nigeria's Defence Industries Corporation of Nigeria's (DICON) promising start in the 1960s[84] was derailed by a lack of funding and seemingly corrupt actions by national officials. Habib believes Nigeria has the resources to become a player in developing and exporting arms and champions DICON's funding needs.[85] This is echoed by Duke, who also calls for oversight regarding DICON's actions.[86] In addition, there is a severe lack of indigenous technological development, and a marriage of military and civilian research and development activities is recommended to support technological innovation.[87]

In a recent comparison of the defence policies of Nigeria and Cameroon, Aisedion and Uwa conclude that both nations' militaries do not possess the necessary human capital, infrastructure or equipment to defend their respective countries. Corruption is cited as a significant reason for this deficiency, with the local industrial sector's immaturity also being a contributing factor. Prioritising technical education and investing in R&D are just two of the many aspects that need attention, along with establishing alliances with nations that possess the capabilities to create a strong defence industry. As with other observers, the authors also maintain that such investment will boost economic growth and have a positive impact on other sectors.[88]

Barriers to success

Abul-Magd makes several pertinent recommendations that Egypt should follow to join emerging countries in arms manufacturing. However, political interference seems to hamper progress, which echoes the Indonesian case: while a nation may have 'good intentions', how these intentions (i.e. policies) are implemented ultimately determines the outcome.[89] This 'baseline' must be achieved and maintained before considering rising into the second-tier region.

As mentioned above, scholars have been extremely critical of the Nigerian government's actions, with a myriad of studies portraying a melting pot of corruption and mismanagement, while unemployment and poverty, not to mention a volatile security situation, are seemingly ignored.[90] It appears that corruption, especially in sub-Saharan Africa, has proven to be a significant barrier to achieving a thriving defence industry (never mind tending to some of the other basic needs of some nations). Oyosoro uses Transparency International's corruption integrity index to examine the region's poor standing; critically analyses of case studies from Nigeria and Niger reveal a lack of oversight concerning the use of public funds for defence, with decision-making processes being unclear. Maintaining that defence industries are crucial for ensuring economic growth, Oyosoro promotes the establishment of defence industrial bases in sub-Saharan Africa to reduce foreign dependence, and hence the potential for corruption.[91]

Consideration could also be given to Panazan and Gheorghe's quantitative analysis of financial mismanagement in the Romanian defence industry, which may be applied to nations afflicted by such obstacles.[92] It should also be noted that a third-tier placing does not necessarily imply a high corruption index rating.

The case of the South African Defence Industry

What of South Africa? Consider the fact that the end of the Cold War resulted in the global reduction in defence budgets, with first and second-tier nations re-evaluating the need for large and self-sufficient defence industries. As presented above, changing innovation strategies and focusing on international cooperation and exports have resulted in success for these nations. The end of Apartheid corresponded closely with the end of the Cold War. The constraints experienced elsewhere – defence downsizing, job losses and a shift in defence policies – were not unique to South Africa. However, South Africa's socio-economic situation was distinctive as the country was in extreme flux as the path to democracy was befittingly forged.[93]

Gopaul et al. and Putter adequately document the many distinctive and innovative military developments made during the Apartheid years, many of which continued into the democratic era. Notable examples include Electronic Warfare expertise, artillery systems, air-to-air missile and 'smart' bomb development, electro-optics sensors, unmanned systems, command and control systems, and world-class test and evaluation facilities and ranges. Some of these achievements began in the 1960s, while some saw seeds sown in the mid-nineties.[94] With an environment conducive to innovation and a national drive for identity, the need for defence autarky saw South Africa provide handsomely for its military. Considering Table 1, these advances seemingly put South Africa above the 'adaptor and modifier' category and in the first tier, but for the overwhelming support provided by the government. The South African Defence Industry would not have been able to achieve its many accomplishments without the state's consistent influence, support and control. As some scholars have noted, the 'militarisation of South African society' made it the nation it eventually became – a pariah state that more than adequately supported its military in the inimitable conditions of the southern portion of the continent.[95] Another factor that would not elevate South Africa to the first tier during the isolation years was its domestic focus.

Given the trend of defence-related funding of the past two decades, the desperate calls for government support seem unlikely to see the light of day.[96] Again, considering Table 1, it is interesting that little or no government support would point to a first-tier defence industry operating independently to support a nation's military, which is not where South Africa currently falls (this was also not the case during the isolation years). In addition, if the very negative corruption trajectory continues, the question needs to be asked as to whether the country could follow the fates that have befallen other sub-Saharan states. Therefore, these characteristics would appear to have South Africa straddle all three categories.

It would thus seem that South Africa almost defies categorisation within the three-tier system, whether in the past or the present. Granted that the structure itself is a guideline, it would nevertheless be compelling to classify the South African Defence Industry as convincingly as possible, especially since the tiers are often referred to in scientific publications. Considering then the reviewed literature, it may be worthwhile to come full circle and examine in detail the major theme that has been identified – innovation in the defence space. Taking into account the many changes that have occurred in the worldwide defence arena since the end of the Cold War, Tai Ming Cheung has proposed a conceptual framework for defence innovation that would assess the state of defence innovation across countries, technologies and products. It considers a myriad of factors impacting the defence innovation process, each featuring multiple variables, with the relationships between the factors indicating the health of the defence innovation system.[97] Highly recommended for future work, how South Africa fares would make for a fitting placement of the country's defence capabilities in the world arena (with due consideration to South Africa's relatively high GII ranking), as innovation is the ultimate measurement tool for determining a nation's defence industry's potential.

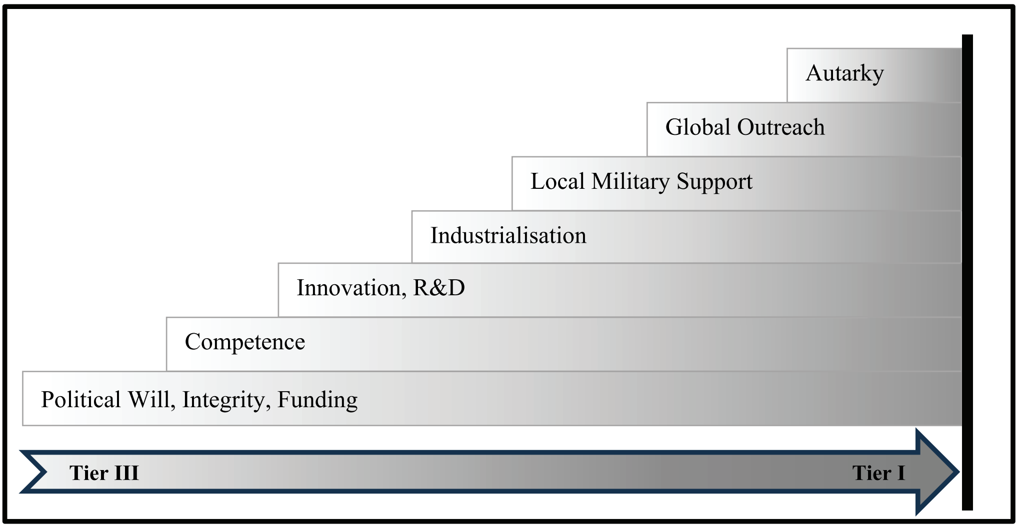

Figure 2. High-level conceptual outline for tier ascension. Source: The authors.

With due consideration of the various concepts and measurement approaches described above, a high-level conceptual framework for a nation's path through the three tiers has been developed (see Figure 2), illustrating the capabilities that should be established and maintained during the journey. This elementary outline could be augmented by weightings for each of the aspects discussed, a timeline proposed, and each concept analysed thoroughly to develop a comprehensive framework. Finally, validating the framework would provide confidence in the model and, at the very least, could serve as a companion piece to the defence industry categorisation, besides providing a foundation that nations could potentially rely upon. This would make for compelling future work and is considered one of this research's major (albeit inadvertent) outcomes. Coupled with the defence innovation framework, an output that could aid in fortune for the South African Defence Industry may be forthcoming.

Concluding remarks

The common themes of techno-nationalism, globalisation, investing in the defence industry to propel economic growth, dual-use technologies and the focus on exports are brought to the fore with the above discussion. The concept of innovation, however, far outweighs all other themes. Be it a first-tier nation or a third-tier country that is hoping to establish or enhance its defence industry, innovation is seen as crucial. First-tier nations have focused and invested heavily in their local R&D capabilities and have ensured that their innovative skills remain relevant and that they push the envelope regarding technological advances. Second-tier defence industries engage in such activities but are often constrained by various factors; nevertheless, they attain certain levels of innovation with healthy doses of support from their respective governments. As advised by Bitzinger and DeVore, significant initial investment is required to ensure independent innovation – the road to achieving this goal is often challenging.[98] Third-tier nations, with particular emphasis on Africa, recognise the need for strong innovation capabilities, providing the basic human capital and infrastructure that they often lack are in place.[99] Considering globalisation, DeVore advises that while defence-industrial globalisation is transforming how states derive value from their domestic defence industries, small and medium states can nevertheless achieve success, with a viable option being integrating into the global defence market using combinations of exports and foreign direct investment,[100] ably demonstrated by South Africa in the early 2000s.

Returning to the initial objective of this exposition, where the South African Defence Industry second-tier classification has been scrutinised along with its standing in the international arms industry, it can be concluded that South Africa's distinctive history indicates an identity that cannot easily be compartmentalised. Indeed, several authors discuss the notion that a nation's unique characteristics and history be considered when analysing its defence industry and, subsequently, the technology and innovation behind that nation.

The South African Defence Industry survived the post-Cold War changing world order with the SDP, particularly the Defence Industrial Participation (DIP) programme, opening up the international arms market. The foundational government support during the isolation years allowed the industry to flourish on its own. However, a fundamental variable in the equation has seemingly disappeared – the support and funding for the local customer (the SANDF). The export success masked the importance of government support for the domestic customer. Much of the content of this piece emphasises the prominent role that the military of the nation in question plays in this picture. Therefore, the ultimate question presented is that if the dismal defence budget trend continues, would the South African Defence Industry survive into the future?

Notes

1. Gopaul et al., 'South African Defence Industry'.
2. Roni et al., 'Sustainable Defense Industries'; Cilliers, 'A Brave New South African Defence Industry'.
3. Gopaul et al., 'South African Defence Industry'.
4. SA Government, *Defence Industry Strategy*.
5. Matthews et al., 'Decline of South Africa's Defence Industry'; Gopaul et al., 'South African Defence Industry'; Dunne et al., 'South Africa and its Defence Industry'.
6. Gopaul et al., 'South African Defence Industry'.
7. Putter, 'Strategic Business Levers'; Gopaul et al., 'South African Defence Industry'; Matthews et al., 'Decline of South Africa's Defence Industry'; Dunne et al., 'South Africa and its Defence Industry'.
8. Roni et al., 'Sustainable Defense Industries', 1–9; Cilliers, 'A Brave New South African Defence Industry'.
9. Bitzinger, *Towards a Brave New Arms Industry*.
10. SA Government, *White Paper*.
11. Roni et al., 'Sustainable Defense Industries'.
12. Bitzinger. 'Defense Industries', 455.
13. SIPRI.
14. Ibid.
15. Sachs et al., 'Globalization Report'.
16. Szmigiera, *Leading Export Countries*; Sachs et al., 'Globalization Report'.
17. Sachs et al., 'Globalization Report'.
18. Dutta et al., 'Global Innovation Index 2023'.
19. Ibid.
20. Defence Companies Index 2020.
21. Ibid.
22. Government Defence Integrity Index 2020.
23. Kerr, 'South African Defence Sector'.
24. Roni et al., 'Sustainable Defense Industries'.

25. Scortecci, 'European Defense Industry'.
26. Gouré, *Winning Future Wars*; Guay, *Globalization*; Mahoney, 'United States Defence Contractors'.
27. Simões et al., 'Portugal's Defense Industry'.
28. Scortecci, 'European Defense Industry'.
29. Ibid; Palavenis 'Swiss Defence Industry'.
30. Scortecci, 'European Defense Industry'.
31. Fiott, *A European Defense Company Today*; Gouré, *Winning Future Wars*, McGinn, *Building Resilience*.
32. Belin et al., 'Defense Firms'.
33. Bitzinger, 'Defense Industries'.
34. Ibid.
35. Seren, 'Dynamics of Turkish Defense Industry'.
36. Sezgin, 'Defence Spending'; Sezgin, 'Empirical Analysis'; Yildrim, et al., 'Military Expenditure'.
37. Bayram, *Rising Power*.
38. Cannon, 'Turkey's Military', in *Turkey in Africa*.
39. Achmadi et al., 'The DIB'.
40. DeVore, 'Domestic Arms Industries'; DeVore, 'Arms Production'.
41. Fiott, *A European Defense Company Today*.
42. DeVore, 'Domestic Arms Industries'.
43. Ibid.; DeVore, 'Arms Production'.
44. Ikegami, 'Swedish Defence Industry'.
45. Das, 'Indian Defence Industry'; Mital et al., 'Make in India'.
46. Das, 'Indian Defence Industry'.
47. Mital et al., 'Make in India'; Das, 'Indian Defence Industry'.
48. Mital et al., 'Make in India'.
49. Czulda, 'Defence Industry in Iran'.
50. Bakhshi, 'Iran – South Africa Relations'; Chehabi, 'South Africa and Iran'.
51. Czulda, 'Defence Industry in Iran'.
52. Ibid.
53. Gaub et al., 'Defence Industries in Arab States'.
54. Ibid.; Biscop et al., 'Military Factors'.
55. Bitzinger, 'Defense Industries'; Bitzinger, 'A New Arms Race?'
56. Edgerton, 'Contradictions of Techno-Nationalism'.
57. Bitzinger, 'Defense Industries'.
58. Etzkowitz et al., 'Innovation in Brazilian Economic and Social Development'.
59. Simões et al., 'Portugal's Changing Defense Industry'.
60. Ibid.
61. Terlikowski, 'Defence Policy in Poland'.
62. Palavenis, 'Swiss Defence Industry'.
63. Mital et al., 'Make in India'.
64. Kishore, 'Defence Production'.
65. Bağcı et al., 'Turkey's Strategic Choice'.
66. Biscop et al., 'Military Factors'.
67. Donelli, *UAVs and Beyond*.
68. Yaylali et al., 'Turkey's Fifth-Generation Fighter Plane'.
69. Ghazinoory et al., 'Sociotechnical Transitions'
70. Farzanegan, *Military Spending*.
71. Yildirim et al., 'Military Expenditure'.
72. DeVore, 'Domestic Arms Industries'; Biscop et al., 'Military Factors'.
73. Biscop et al., 'Military Factors'.
74. Gaub et al., 'Defence Industries in Arab States'.
75. Roni et al., 'Sustainable Defense Industries'.
76. Danssaert, *Defence-Related Companies*.
77. Ammour, *Evolution of the Algerian Defence Policy*.
78. Dekhakhena, 'Algeria Considering Changing its Military Doctrine'.
79. Němečková et al., 'Russia's return to Africa'.

80. The Arab Weekly, *Defence Manufacturing Self-sufficiency in Morocco*.
81. Němečková et al., 'Russia's Return to Africa'.
82. Biscop et al., 'Military Factors'.
83. Abul-Magd, 'Egypt's Defense Industry'.
84. Habib, 'Arms Procurement'; Duke, 'Military Logistics'.
85. Habib, 'Arms Procurement'.
86. Duke, 'Military Logistics'.
87. Dii, 'Indigenous Technological Development'; Oyosoro, 'Building Integrity'.
88. Aisedion et al., 'Understanding Defence Policy'.
89. Abul-Magd, 'Egypt's Defense Industry'.
90. Nenbee et al. 'Defence Spending'; Minini et al., 'National Defence Expenditure'; Aduma et al., 'Defence Budget and National Security'; Okolie et al., 'Government Defence Expenditure'.
91. Oyosoro, 'Building Integrity'.
92. Panazan et al, 'Aspects of Risk'.
93. Gopaul et al., 'South African Defence Industry'.
94. Putter, 'Strategic Business Levers'; Gopaul et al., 'South African Defence Industry'.
95. Gopaul et al., 'South African Defence Industry'.
96. Ibid.
97. Cheung, 'Conceptual Framework'.
98. Bitzinger, 'Defense Industries '; DeVore, 'Arms Production'.
99. Gaub et al., 'Defence Industries in Arab States'; Oyosoro, 'Building Integrity'; Dii, 'Indigenous Technological Development'; Aisedion et al., 'Understanding Defence Policy'.
100. DeVore, 'Domestic Arms Industries'.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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