

# In which defence technologies should Middle East governments invest





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## Abstract

The technologies most valuable to national defence are those that maximise the nation's freedom to develop and use its military capability as it sees fit. Technologies that enhance interoperability with allies or mitigate supply chain dependencies are therefore particularly important. These may not appear to be the most economically attractive choices in a traditional export-focused sense.

The 'make or buy?' question is the same for all nations but the answer is different for each. Middle East nations should learn from others but not imitate the solutions of industrially developed nations. Developing regional competence in systems integration, research, development, test and analysis will have more strategic impact towards ensuring national security and resilience than competing with established, over-capacity producers.

Offset policy can and must encourage foreign investment in the most beneficial technologies and, more importantly, in transferring the knowledge that underpins them. All offset proposals, traditional joint ventures or otherwise, should be judged by their contribution to building knowledge capital and thereby national freedom of action.

Developing human capital (education, knowledge transfer, research, development, and training) is essential to achieving independent indigenous defence capability and more beneficial than replicating production facilities in competitive market areas.

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## Reasons to invest in Defence Technology

Effective use of technology underpins modern military capability. It enables operational advantage, such as controlling airspace and providing real-time situational awareness and intelligence. Government investment in technology ranges from buying “off-the-shelf” through providing manufacturing capacity to funding fundamental research and development. The most powerful military forces rest on complex supply chains underpinned by long-established research, development and evaluation expertise.

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**Control over the development and production of key technologies that enable the freedom to act as the nation chooses is paramount**

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This suggests that, in a world of shifting alliances and asymmetrical threats, control over the development and production of key technologies that enable the freedom to act as the nation chooses is paramount.<sup>(1)</sup>

Moreover, fundamental to this approach is the ability to test the employment of equipment theoretically and practically to assure its effectiveness, the safety to its users, and to explore the boundaries of its potential. States will then have greater bargaining power and choice to acquire state-of-the art systems in which others have already invested, in the knowledge that they will be able to integrate diverse systems from different territories into their arsenal.

This being so, the technologies most valuable to national defence are those that maximize the nation’s freedom to develop and use its military capability as it sees fit – wherever, whenever, with whomever. Technologies that enhance interoperability with allies or mitigate supply chain dependencies are therefore particularly important. These may not, however, appear to be the most economically attractive choices in a traditional export-focused sense.

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## The economics – Defence is a government business

The paramount role of a state is to protect its citizens and, therefore, governments collectively bear the burden of funding the full cost of defence. Globally, defence spending is a small percentage of GDP yet governments have high expectations of their investments, whether funding public enterprises or contracting with the private sector. Private industry is obliged to profit from its undertakings and government and industry are, therefore, inextricably linked in the Defence domain. It is, after all, a matter of life and death.

Industrial investments that promise export opportunities are immediately attractive but are not necessarily those that maximise military capability or enhance independent action. Different criteria may be needed to provide future proofing for the Armed Forces.

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**“Dreams cannot be realized if they are not based on reality. Otherwise, they would be no more than a mirage.”** – HH Gen Sheikh Mohamed bin Zayed Al Nahyan the Crown Prince of Abu Dhabi, Deputy Supreme Commander of the UAE Armed Forces<sup>(2)</sup>

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## Make or Buy?

The ‘make or buy?’ question is the same for all nations but the answer is different for each. The optimum strategy balances independent military capability with cost, while taking realistic account of factors such as the breadth and depth of the existing industrial base, the workforce available, the science and engineering research base, and the opportunities of the regional market place.

An indigenous defence industry contributes to GDP and provides leverage to the nation as a customer but every new national defence industry increases the global over-capacity and the defence market becomes consequently more dysfunctional. National security interests influence the availability of equipment and knowledge transfer. This is particularly important for nations without significant, established industrial bases. The questions are:

- Which parts of the supply chain are most critical and need to be ‘owned’ or controlled?
- What components and systems will be freely available and therefore not need to be owned?
- What knowledge and skills need to be embedded in the indigenous workforce to safeguard sovereignty?

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**Middle East nations should learn from, not directly imitate, solutions created by more industrially developed nations**

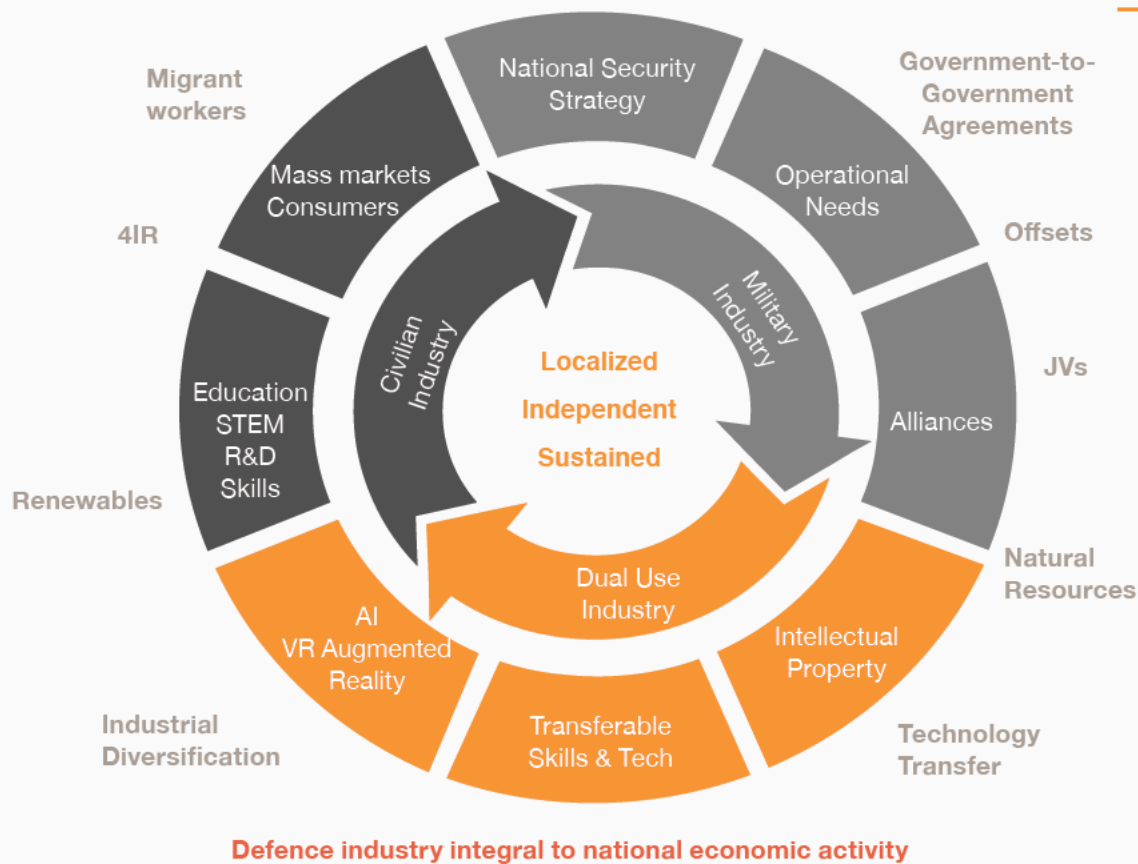
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There may be no economic sense or defence necessity to own traditional, large-scale vehicle production facilities if those vehicles will remain readily available. But understanding and being able to modify sub-systems, networks and artificial intelligence may not only safeguard sovereignty but also provide leverage in an alliance and improved access to other technologies.

Middle East nations should learn from, not directly imitate, solutions created by more industrially developed nations. Developing regional competence in systems integration, research, development, test and analysis will have more strategic impact towards ensuring national security and resilience than competing head-on with established, over-capacity producers.

In this context, the potential for cross-over with investment in non-defence technologies should be given careful attention. Economic realities are such that in the late 1990s it was estimated only 24% of the end items produced in the Egyptian Ministry of Military Production factories were actually military, the remainder being dual-use or purely civilian.<sup>(9)</sup> Any investment should be judged on factors including: the scope for increasing indigenous labour participation; the exploitation of indigenous raw materials; economic diversification; and the enhancement of knowledge-based economies, fully embracing the Fourth Industrial Revolution (4IR). Such an approach may also result more easily in achieving a critical mass of expertise, industrial capacity and revenue.





## Turning technology into capability

Technology by itself does not convey capability. Much has been written about the mismatch between substantial investment in defence equipment and the operational performance of the Forces armed with it, especially in the Middle East.<sup>(4)</sup> Military capability comprises of, as a minimum, trained people with appropriate equipment. These two components are the primary drivers of potential capability. In all walks of life, it is observed that ‘good people’ will succeed even with poor tools but excellent tools do not always compensate for lack of skill. This is particularly the case in the military sphere, where prosecution of the enemy cannot be automated or delegated to machines alone.

The combination of people and equipment is still insufficient to establish military capability. Effective fighting forces need to integrate tactics, doctrine, logistics, information and other infrastructure to succeed. Long-established defence forces have developed their definitions of capability to include all these, summarised by acronyms such as “TEPIDOIL” (UK) or DOTMLPF (US).<sup>1</sup>

Typically, personnel and training are broken out as separate components so that, if personnel and equipment define the maximum achievable capability, all the other components become efficiency factors. Using the wrong tactics can be disastrous. Insufficient or inappropriate training means that people do not achieve their potential – training is the most pervasive of these efficiency factors. As a result, investment in training system technology and training expertise seems to be a priority.

<sup>1</sup>TEPIDOIL = Training, Equipment & technology, Personnel, Information, Doctrine & concepts, Organization, Infrastructure, and Logistics.  
DOTMLPF-P = Doctrine, Organization, Training, Materiel, Leadership and education, Personnel, Facilities, and Policy.

Technology investment options should, therefore, encompass the full range of technology-related activity described earlier. Moreover, Armed Forces and Defence Ministries need to articulate capability requirements within a planning framework that provides clear priorities and lines of sight that enable sound 'make or buy' investment decisions.

The GCC member states aspire to create knowledge-based economies, and Henrik Von Scheel, the so-called 'father of the Fourth Industrial Revolution' has already applauded the UAE for being at the centre of global innovation, investing heavily in the technologies of the future.<sup>(6)</sup> Investments that foster genuine knowledge and skills transfer will have pervasive benefits and may, in the long run be more effective than investing in traditional production capacity that predominantly adds to an already over-supplied market.

### All 'lines of development' contribute to capability on the ground



## What does success look like?

There are many, sometimes contradictory, criteria for success. At a strategic level, the optimum technology investment choices will be those that best enhance sovereignty by supporting national visions and defence objectives:

- contributing to the military capabilities needed to achieve security, stability and prosperity
- enhancing ability to operate in coalitions of choice

From an economic perspective, industrial activity should generate net revenue for the nation; in other words it will lead to exports. But, as already discussed, there may be little scope to penetrate an already over-supplied market. One means of mitigating this challenge would be to consider the issue regionally. This could mean focussing on technology that can be tailored to regional operational requirements, environmental characteristics, and cultural and linguistic norms. Or it could mean pooling, sharing and distributing activity among allied nations to make best use of scarce indigenous skills while avoiding harmful competition.

A regional focus could also lead to implementing investments that enable the use of Arabic languages and reinforce cultural norms different to those of established, global OEMs.

**“We can learn from others’ mistakes and avoid making them ourselves. We aim to leap-frog other nations in our development.”** – Fahad Al Mheiri, Executive Director Business Development, EDIC<sup>(6)</sup>



## Encouraging private companies (economic growth)

A feature of Western nations is that, while governments still exercise strong control for national security purposes, most of the industrial activity is undertaken by private or quasi-commercial enterprises. As a populous nation with established production facilities ranging from heavy engineering to electronics and software, India has chosen a strategy of “self-reliance”.<sup>(7), (8)</sup> Key to this approach is increasing participation by Small and Medium Enterprises (SMEs). The Middle East should also consider the benefits from encouraging local private venture participation, mindful that this may need active support in the early stages. In this respect, the UAE already has established accelerators, investment funds and partnerships that support aerospace-related developments.

## The Aerospace domain – military-civilian crossover

Certain systems, such as fast jets and armed UAS are reserved for military use but there are significant overlaps between military and civilian requirements. In these areas, typified by greater scale of demand, there is a more truly competitive market. There are consequently more opportunities for return on commercial investment as well as satisfying military needs. Technology with broader applications includes communications, control systems, power generation and storage, composite materials, 3D-printing and other ‘disruptive’ production techniques.

## Features of ideal technology investments

In summary, the strongest candidates for technology investment should demonstrate the following features:

- Alignment with national vision
- Emerging technologies – fields where the market will grow
- Technology that can help OEMs meet offset criteria (creating win-win scenarios)
- Open source design (or access to existing Intellectual Property (IP)) with ability to generate new IP (shared if necessary) – as a minimum access to licence to produce/maintain
- Complementary to existing industrial base e.g. petrochemicals, metals
- Use regionally sourced raw materials
- Solving a ‘coalition problem’ – i.e. something that can be sold to coalition partners for in-region operations
- Good regional market (to complement localised production)
- Low manpower/high automation and viable at relatively small scale
- Skills/technology overlap with non-defence technology (critical mass is easier to achieve)



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## So what technologies does this suggest?

The foregoing discussion suggests investment in new technologies as well as the nation's broader underpinning research base. Investments are more likely to be rewarded when they target clearly-defined end states. This plays to short-term investments to fill specific niches, such as making minor modifications to existing technology to meet existing military requirements.

Governments must, at the same time, remain ambitious to develop the indigenous research base and its ability to generate IP. Depending on the country's baseline, this could require fundamental investment in the Science, Technology, Engineering and Mathematics (STEM) education in order to generate the human capital necessary for a self-sustaining research ecosystem.<sup>(9)</sup> Measuring returns on investment in research can be contentious. Research is, after all, undertaken in order to expand knowledge by exploring the unknown, and is often most rewarding when it reveals a previously 'unknown unknown'. This implies a balancing act between short-term objectives that can exercise nascent research capability and long-term commitment, persistence, and courage to accept unexpected set-backs.

Many of the technologies that address requirements related to communications, interoperability and wider C4ISR are electronics- or software-based. Moreover, software and control systems are essential to automation, artificial intelligence, enhanced reality, remote control and the development of increasingly autonomous systems. Indeed, such quasi intelligent systems might underpin the development of truly indigenous production capabilities by augmenting the workforce in harsh, dangerous or dirty environments.

Whereas in populous nations robots and automation may be feared for the jobs they are likely to displace, in states with small populations they will be critical to indigenisation. Technology investments should favour established, accessible IP and open-source software that can be developed rapidly and shared or exported freely.

The thirst for excellence in the development and application of new technology already exists in regional visions such as "Smart Dubai". Consumers, workers and Service Personnel may all benefit from the technology that enables drones to perform "dull, dangerous and dirty" tasks, whether that is autonomous aerial taxis steering safe routes, domestic service devices serving consumers in the home, increased automation in building infrastructure, clearing and cleaning contaminated areas, or constructing military platforms. The talent and technology concentrations developing in response to such initiatives may be the basis for multi-purpose or 'dual-use' or cross-over technologies with both military and civilian applications.

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The commercial benefits of 'big data' and securely encrypted, distributed transaction record systems, commonly known as "Blockchain" are already widely valued. In the defence domain they offer benefits from better intelligence gathering and analysis, detecting anomalous behaviour indicative of malicious activity, as well as more efficient contract management through anticipating project bottlenecks or overruns and assuring transactions.

But technologies should be chosen to cover the whole range of military capabilities and enablers. The list might therefore also include portable and/or renewable energy supplies tailored to the regional climate, supporting operational effectiveness and aligned with existing national objectives around sustainable energy.

Investment in dual-use technologies would also mitigate the economic challenge of defence market over-supply. Healthcare embodies many cross-over challenges, including: remotely controlled or supervised treatment relevant to both operational deployments and remote or sparse populations; trauma medicine; infection control and decontamination. Other opportunities exist to exploit indigenous natural resources. In this category is technology to produce smart, synthetic or composite materials applicable to personal protection, space applications and healthcare, as well as high-volume leisure customers.

Last, but not least, underpinning the development of military capability, nations must invest in developing appropriate abilities to test and evaluate their products, and the training systems needed to prepare their personnel for operations. To date, many of these services have depended heavily on Ex-patriot service personnel and veterans, overseas test areas and reliance on copying the procedures and tactics of exporting nations. Mastering these capability enablers would be one of the strongest indicators of military industrial independence, self-reliance and sustainability.

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**“We will very carefully evaluate what our partners can bring to the table.”** – Andreas Schwer, Head of Saudi Arabian Military Industries<sup>(10)</sup>

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## Offsets – incentivising the most prized investments

Offset programs are frequently criticised for not delivering the benefits initially promised, whether that is due to over-optimism or a lack of genuine commitment to identifying and offering mutually beneficial investment. Attitude certainly plays a part but offset programmes should be crafted, and evolved, to incentivise investments that confer lasting capability and skills for self-development, as was discussed at the 2016 Global Aerospace Summit.<sup>(12)</sup> There is a web of interactions here: governments and industry alike will benefit by planning offset activity constructively from the outset. Localisation and technology transfer are justifiable objectives. Suppliers should also consider the future opportunities of a greater regional skills base and production facilities.

**“We are committed to making the Tawazun Economic Program one of the world’s best by focusing on, and investing in, skilled, dedicated people as well as cutting-edge science and technology.” – HE Tareq Abdul Raheem Al Hosani, CEO<sup>(11)</sup>**

**“View the Tawazun program as a strategic opportunity, not as an obligation. We took this positive approach and launched a venture in 2016 that not only fulfilled our obligation quickly, but also continues with great prospects ahead.” – Keith Driscoll, Board Member, Gulf 3D Technologies, LLC**





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## Conclusion

Each nation is free to decide its own technology investment priorities, taking account of its aspirations for military autarky, alliances, perceived threats and industrial ambitions.

A framework to facilitate such decisions might include assessing drivers, including the following:

### **Military Capability Requirements**

- Own critical requirements
- Allies' requirements
- Regionally specific requirements
- Potential to share specifications

### **Commercial aspects**

- Availability & security of supply
- Cost of entering the market
- Military-civilian crossover
- Export potential

### **Technical aspects**

- Indigenous skill base
- Scope to develop local IP (R&D)
- Knowledge transfer opportunities

Whatever technologies are chosen as priorities the investments will be successful only if governments remain proactive in facilitating the environment for their success. This must include providing policy, legal and regulatory frameworks and processes that guarantee funding, protect intellectual property and provide equitable incentives. The viability of defence industrial bases increases where thriving civilian industrial bases exist. While physical localisation of technologies is the headline objective, this must be underpinned by investment in the local human capital that will embody the necessary skills, knowledge and experience to achieve true freedom of action in defence technology, and thereby military advantage.





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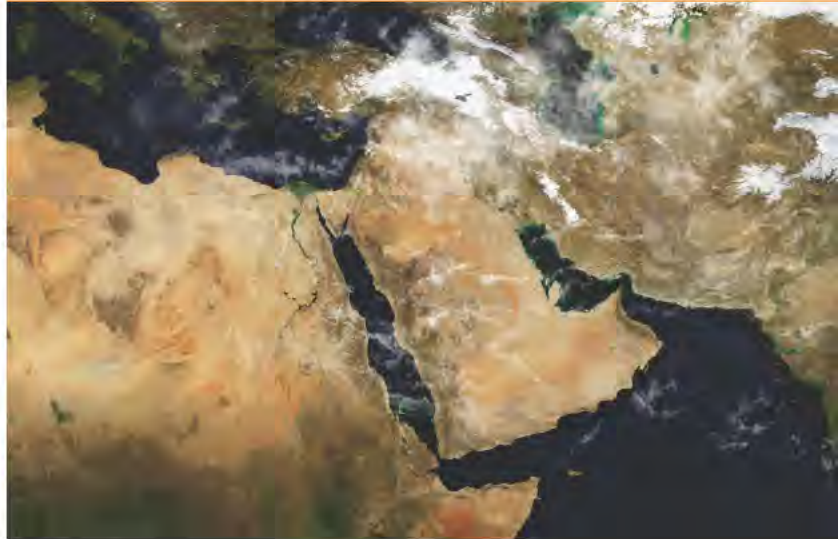
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## About PwC Middle East Defense Practice

PwC has operated in the Middle East for over 40 years.

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Our tailored Defence solutions help clients to meet the challenges and opportunities of doing business in the Middle East market and beyond.



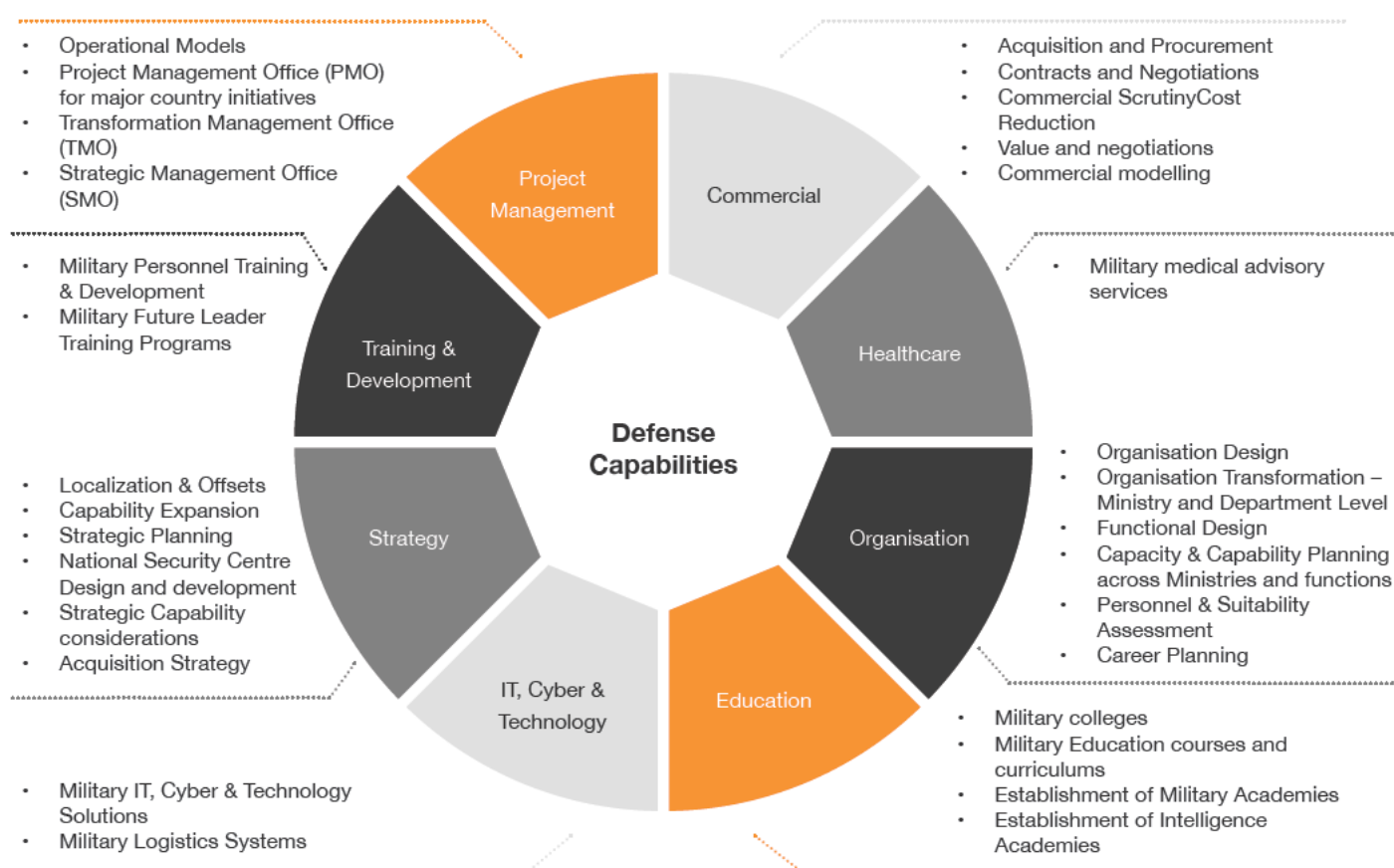
**PwC's Middle East Defence Practice provides advisory services across a wide range of areas, particularly focusing on:**

- Defence Acquisition Scrutiny Organisation
- Strategy and Localization Approach in KSA
- Defence Education & Training
- National Defence Procurement Agency Transformation
- Designing a bespoke assessment platform
- Talent Identification & Selection
- Establish a Transformation Management Office (TMO)
- Establishment of National Security Entity

**We have delivered defence solutions for numerous defence clients, in the region and internationally including:**

- Establishment of an acquisition scrutiny organisation.
- Detailing the strategy and approach to localization in KSA for a leading defence international OEM.
- Establishment of a Transformation Management Office for an MoD organisation in the region.
- Establishment of a National Security Entity in the region
- Development of industrial development and localization agenda for government regulatory client.
- Transformation of regional ship building capability.
- Evidence based transformation of a leading Air Force

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## About the Authors



**Susanna Mason**

Lead Partner Defense Middle East  
Abu Dhabi

☎ M: +971 0 52 650 4920

✉ susanna.mason@pwc.com

Susanna has worked in defence related jobs for the last 22 years. Before re-joining PwC she spent 8 years in the UK Ministry of Defence across a range of commercial strategy and defence export roles before leaving as 3\* Director General Commercial. She has wide ranging commercial, procurement, negotiation and restructuring experience at the highest level of government and with foreign governments across EMEA and Australia. She has worked closely with the major defence equipment and service providers at CEO level. She also has designed and implemented legal regulation for single sourced military equipment and services. She is a experienced bid manager for multi million dollar bids, and has been a lead negotiator for the UK government.



**Lewis Kenney**

Chief of Staff ME Defense Practice  
Abu Dhabi

☎ M: +971 0 54 791 5248

✉ lewis.kenney@pwc.com

Lewis has run defence projects in the UAE and the UK over the last 10 years. Operating in both the defence industry and military sectors, Lewis has established, managed and overseen large defence projects in the areas of capability development, Operations & Maintenance, Operational Training, Design and Construction, efficiency improvement and training needs analysis.

Lewis has worked with military clients including NATO, the UK Armed Forces and the UAE Presidential Guard. Lewis has also worked for and with leading defence industrial organisations including Lockheed Martin, KBR, the KSA General Authority for Military Industries (GAMI) and the KSA Saudi Arabian Military Industries (SAMI).



**Christian Seear**

Manager ME Defense Practice  
Abu Dhabi

☎ M: +971 55 326 0259

✉ Christian.Seear@pwc.com

Christian is a Manager for PwC Defence in the Middle East and has worked in Defence-related jobs for over 6 years. Before joining PwC, Christian worked with Babcock International in the UK & Middle East, establishing multiple joint venture projects in UAE & Oman. Christian is highly immersed within the regional industrial community, engaging regularly with local and international entities to develop their market entry approaches. He has strategy and commercial experience at executive level and has supported clients ranging from business unit leaders to country director's.



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