Defense & Security Analysis

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/cdan20

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To cite this article: Kogila Balakrishnan & Zsolt Lazar (2022) The challenges in buyer-supplier relationship for technological absorption capability in international defence acquisition: the case of Southeast Asia, Defense & Security Analysis, 38:3, 317-335, DOI: 10.1080/14751798.2022.2093460

To link to this article: https://doi.org/10.1080/14751798.2022.2093460

Published online: 29 Aug 2022.

DEFENSE & SECURITY ANALYSIS
2022, VOL. 38, NO. 3, 317–335
https://doi.org/10.1080/14751798.2022.2093460

Routledge
Taylor & Francis Group

The challenges in buyer-supplier relationship for technological absorption capability in international defence acquisition: the case of Southeast Asia

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ABSTRACT

Transfer of technology (TOT) is a contentious issue in the international defence trade. In 2019 it was estimated to form at least 40%, or $123 billion USD, of total international defence trade. Whilst purchasing nations set requirements for TOT within their industrial participation (IP) policies, there is often a mismatch between the scale and type of technology suppliers can offer and the buyer's technological absorption capability (TAC). This persistent tension between ambition and reality frequently strains the buyer-supplier relationship. Thus, understanding how TAC can be enhanced is of vital importance. This paper defines TAC in the international defence acquisition and offsets context and determines the factors for successful TAC. The paper focusses on the potential challenges for successful TAC and offers recommendations on how to enhance TAC. This research is limited to the context of Southeast Asia. The respondents consist of industry, government and academics who operate in the Southeast Asian defence and security sector.

KEYWORDS

Absorptive capability; technology transfer; collaboration; buyer; supplier

Introduction

The economies of Southeast-Asia are one of the fastest growing ones in the world and have long outpaced the global growth.[1] They are advancing fast, mostly due to rapid urbanisation, infrastructural investments, emergence of technology-based businesses,[2] and as a result of the modernisation programmes, a domestic obligation to the home-grown defence industry.[3] Therefore, it is not surprising that the region was called the next growth opportunity in defence, and several countries in the region have attempted to build strong and technologically-advanced defence materiel production.

In the past ten years the region's defence expenditure increased by 33% in real terms and the import almost doubled compared to the 1999–2008 period. This implies a mean 1.8% GDP spending on average,[4] and because of procurement and co-operation in production, a massive technology transfer as well.

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Transfer of technology in international defence acquisition and collaboration

Transfer of technology (TOT) is not a recent phenomenon and has existed throughout recorded history. Suffice it to mention the technologies accelerated through the British Industrial Revolution in the nineteenth century, as a result of metallurgy, machine-making, and transportation.[5] Technology transfer is not a linear process and is far more complex and evolutionary in nature. Technology recipients must have the capability to alter, modify, and adapt the technology in various ways despite technical nuances. Sometimes this is also labelled as "improvement engineering" where foreign technology is reshaped to suit local requirements with higher degrees of sophistication.[6]

Technology transfer occurs as a by-product of the arms trade in international defence acquisition and collaboration. Usually, the demand for foreign technology on the part of the buyer nation (government) is an ancillary demand to the main procurement of the product or services that are being imported. This additional demand is labelled as offsets, or industrial collaboration, defined as additional benefits offered by defence suppliers to buyers as part of sales.[7] Offsets has become increasingly important, but also demanding. Requirements have become more stringent but also highly complex and challenging, with buyers now requesting a high level of technology and local content. It is estimated that at least 80 countries around the world practise some form of offsets, with this number continually increasing.[8] Defence suppliers are required to transfer technology or deliver capability as part of sales. Often, offsets or industrial collaboration, is offered as an additional benefit to gain a competitive advantage.[9] However, technology transfer through defence acquisition is also highly contentious and has resulted in various disputes.[10,11] Some nations have been very punitive to suppliers who do not deliver or adhere to contracts. Examples in the past include Greece, Italy, and India where offsets authorities have slapped major suppliers with high penalties and liquidated damages for non-performance.[12]

In the context of this paper, most original equipment manufacturers (OEMs) operating in SEA whom were interviewed indicated that buyer nations typically have a high level of aspiration, which is not matched by their TAC.[13,14,15,16] Despite this, reasons behind the low level of TAC within defence technology recipients remains under-researched. This is partly due to the challenges naturally arising from a lack of access to technology recipients and donors who are willing to share data and be transparent, largely due to commercial non-disclosure agreements and security issues.

At the same time, research focused on TAC in defence acquisition management is becoming increasingly critical for the following reasons.

(1) An increasing number of purchasing countries requesting some form of TOT through platforms such as offsets or industrial collaboration. For example, the UAE's Tawazun Economic Policy, the Kingdom of Saudi Arabia's (KSA) industrial collaboration policy,[17] Malaysia's Industrial Collaboration programme[18] and Australia's Defence Industry Capability plan.[19]
(2) A keen interest from OEMs to develop a robust supply chain that supports their products and services, as well as enhances the capabilities of their recipients.[20,21]

(3) The increasing amount of literature that supports the narrative of unsuccessful TOT due to a lack of TAC as a major cause of disputes between buyers and suppliers.[22,23]
(4) An increasing rate of TOT project failures due to a lack of TAC within technology recipients based on the authors' personal observations.[24]

Hence, this paper addresses the following question:

How can TAC be enhanced in an international defence acquisition and collaboration environment?

To answer this question, we identified two objectives:

- What is TAC in the international defence acquisition and collaboration context?
- What are the determinants for successful TAC in an IAC environment?
- What are the challenges for technological absorption?

The authors have taken a pragmatic interpretative philosophical approach, using a case study method focused on TAC for defence technology donors and recipients in an IAC in Southeast Asia. Primary data sources include in-depth interviews to produce a thematic discussion, as well as secondary resources such as journal articles, government reports, and online resources related to government and other agencies websites. The author argues that attaining technological absorption capability within the defence sector is reliant on strategic bilateral relations between the buyer and supplier nations; followed by the donor (exporter) and technology recipient (importer) relationship, R&D capability, defence industrial and technology strategy, firm strategy, supplier commitment, as well as knowledge and skills of the acquisition community. The paper uses a novel TAC framework to demonstrate the factors that contribute to successful TAC at firm level in the context of international acquisition and collaboration (IAC).

Defining TAC in the context of international defence acquisition and collaboration

TAC is a vital indicator that reflects technological and innovation capability.[25,26,27] The concept of TAC originated in macro-economics, which focuses on the ability of nations to absorb and utilise external information and resources for economic growth.[28] The most popular definition of TAC was provided by Cohen and Levinthal, who stated as the firm's ability to recognise the value of new external information, assimilate it, exploit, and apply the knowledge to commercial ends.[29]

We summarise TAC in the following sequence. First, as the ability to select or identify technologies. Then, the ability to assimilate the technology into the organisation, by adaptation, modification and upgrading, or localising the technology. The end objective for the technology recipient is to be able to create new products, or manufacturing processes, improve organisational efficiency, and achieve necessary quality certifications. The intention is also for the recipient to use the absorbed technology to create a competitive edge and make profit from the technology through commercialisation.[30]

The challenge is often in deciding the type of technology to acquire, and subsequently in how to adapt and recreate the technology to serve a profitable purpose. Also,

considering the sheer scale and depth of technical fields to draw from, no single firm can produce all the required research alone. This immediately suggests that every firm needs to look outside its boundaries and acquire knowledge from other firms, research labs, and universities to build on their TAC. Countries in East Asia such as Japan, the Republic of Korea (ROK), and Taiwan have understood for many years that the importation of foreign technology is required to leap-frog and acquire the ability to be able to modify and adapt foreign technologies to local needs. But the steep learning curve from the TOT process will provide the basis for an intelligent selection amongst the widest range of potential foreign suppliers. The firms located in the above East Asian countries have capability for substitution, localisation, and adaptation of products bought.[31,32,33]

In the context of defence acquisition, we explain TAC as the ability of the receiving entity, whether it be country, government, industry, or educational institute, to be able to accept, absorb, master, and successfully use the transferred technology; or at least support the wider development of national defence capability, if not in international business and educational sectors.[34,35] TAC must clearly align to core goals of self-reliance and military capability.[36] This objective is in addition to primary economic development goals. In this context, as the technology being transferred is mostly of a highly complex nature, the technology recipient should have the ability to know what the technology is, how to acquire the technology, and how to exploit and use the technology effectively.[37] Such TAC includes knowledge of advanced manufacturing and digital technologies such as machine learning and artificial interlligence (AI).

Buyers also often benefit from low risk of TOT failure as sellers are transferring technology that is mature and well-tested in the market.[38] TAC should be measured by the ability of the technology recipient to utilise the received technologies. Further, success is also dependent on where the organisation's capability resides based on its technological readiness level.[39,40,41] The relevant areas reflecting the capability and maturity of the organisation include knowledge, skills, culture, behaviour, and research capabilities.[42,43,44,45,46]

Additionally, as advanced technology is difficult to obtain and expensive to self-develop, a high-level of TAC lowers the cost of technology transfer to buyer nations. For suppliers, they can see the true benefits of the technology transfer only if the buyers are willing to embrace a global approach to business.

What are the key determinants to high TAC in the context of international defence acquisition and collaboration?

The TAC framework in Figure 1 was developed based on literature and themes emerging from interviews. This model has been modified from an earlier TAC model developed by Balakrishnan.[47] The current TAC model has considered additional critical elements within the international defence acquisition context, including bilateral relationships, defence industrial and technology strategy, and knowledge and skills in IAC within the defence acquisition community, all of which are vital for high levels of TAC. The model also introduces the two important factors of "trust" and "relationship," which form the fundamental basis of the donor-recipient technology transfer environment. This section explains each factor in detail.

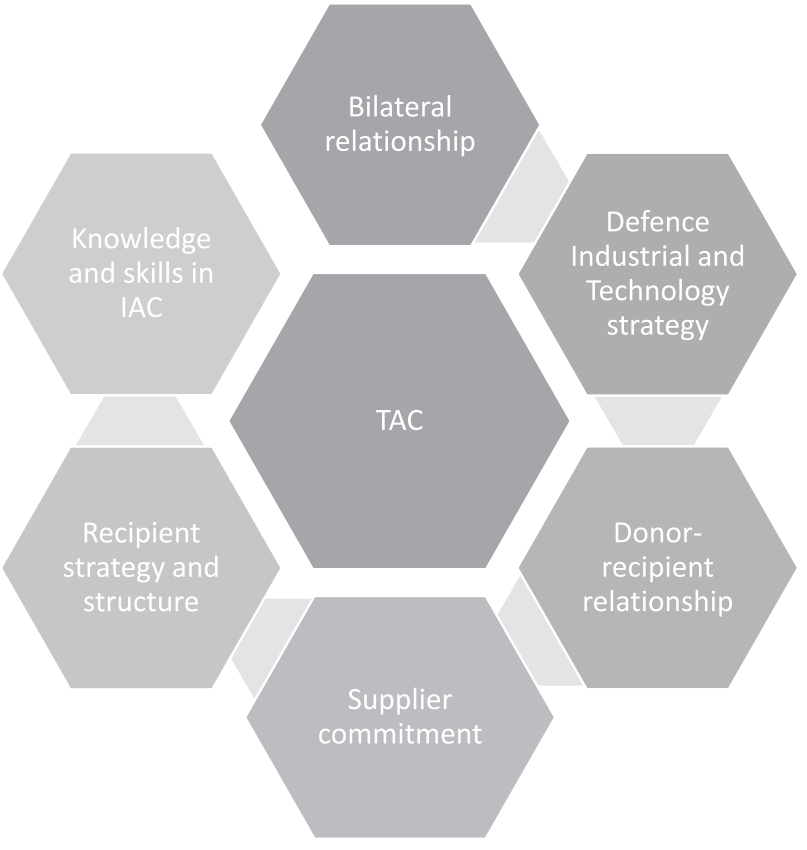

Figure 1. "TAC Framework": Critical success factors to technological absorptive capability.

Bilateral relationships at country level

In the context of defence, a key factor that determines the level of absorptive capability is the strength of the buyer-supplier relationship.[48] However, an important distinction is that this relationship must initially arise from a strategic relationship built at the state-to-state level between two nations. Defence policy is the prerogative of the state and has a huge influence on the national armed forces. The armed forces by default are the primary users of defence products and services produced locally. Suppliers of defence equipment who want to undertake international trade and enter the export market must comply by their own state rules.[49] These rules include adhering to export control regulations, and conforming to the list of approved countries to whom suppliers can sell, based on shared political, economic, and social values.[50,51,52] One respondent mentioned that their company was banned from selling to certain countries due to issues of human rights, corruption, and violation of international law.[53]

Defence industrial and technology strategy

Another key factor that is vital for successful TAC in IAC is related to the buyer nation's industrial and technology strategy.[54,55] A unique feature of defence TAC is a strong state-

to-state mediated dialogue to facilitate the exchange between companies. Hence, robust government intervention is required to facilitate technology transfer to increase TAC.[56] This is where tools like offsets and industrial collaboration policies become central to facilitate TOT. Similarly, steps taken by governments to introduce policies such as defence industrial and technology strategies help shape the thinking of stakeholders on the allocation of resources towards building TAC within their local defence industrial environment.[57] In the defence sector it is important to have a clear technology strategy in identifying and supporting key strategic industries and targeting companies that can undertake this responsibility. Firm-level decisions to invest in capability development can be encouraged by state-level technological foresight, supported by a two-to-three-decade roadmap that can help steer the national technology development trajectory.[58]

South Korea, for example has a sophisticated process for absorbing technology transfers. The Korea Defence Agency for Technology and Quality has developed a database named the Defence Technology information Service which integrates technologies between the various intergovernmental defence agencies. The Agency for Defence Development provides a vision and roadmap for technology requirements, in turn steering government strategy.[59] However, people in such agencies must be trained to acquire the right skills and level of technical ability to be able to identify the technology gap, capture the appropriate requirements, and develop strategies for doing so.

Technology donor-recipient relationship

At the technology recipient or firm level, the fundamental principle for technology transfer in the defence environment is mutual trust and commitment between technology recipients and donors. The donor must believe that transferred technology will be handled safely, protected, and used in a safe environment, with sufficient Cyber-security to protect any intellectual property rights (IPR) from falling into the hands of adversaries.[60] There must be a high-level of trust built into how the technology recipient will deal with IPR, licences, and robust firewall systems must be demonstrated for such technologies. Additionally, the political and economic nature of international defence acquisition and collaboration means that there must be a deep level of trust and good relationships between state actors to make TOT effective, which in turn stimulates genuine TAC.[61]

Supplier commitment

On the supplier side, it is often the case that successful TOT to ensure effective TAC is also based on the choice of technology recipient or partners. The recipient must demonstrate responsibility, financial commitment, and be willing to view the business as long-term. An existing partner that has state and end-user support, with some level of technological capability, steady financial status, skilled workers, and in-house R&D capability will be a more productive partner for the technology donor or supplier. First tier suppliers or platform makers have better control and ability to undertake TOT, compared to tier two or three suppliers who solely rely on the technology for their business survival. Several respondents argue that a joint-venture (JV) collaboration is a better model for building overall local industrial capability, with the supplier viewing the business as

important for continuity and sustainability of relationship.[62,63] Obviously, as the government is the largest customer in the host country, there must be a long-term strategic view to committing to a product and looking for strategic partnerships at the state and firm level, to ensure a sufficient level of business will be generated to justify setting up a JV.[64] The TOT process could also expose suppliers to the commercial risk of losing their competitive advantage. Therefore, managing the expectations of stakeholders and balancing relationships through inter-party trust building is essential.[65]

Firm/technology recipient strategy and structure

Respondents mentioned that a sufficiently skilled workforce that can absorb, assimilate, and adapt new technologies to the local environment is critical to TAC.[66,67,68] At the firm level, prior related knowledge, the level of employees' readiness, and intensity of efforts (including technical skills, experience, communication skills, and willingness to learn) affect technology transfer performance.[69] Cohen and Levinthal mentioned that countries that were most successful in borrowing foreign technologies were those that had a well-educated population.[70] They also mentioned that the initial gap between the donor and technology recipient should not be too wide for successful TOT to occur. This means recipient firms must have strong qualified researchers with engineering and technical skills who are able to understand external knowledge spill-over and recognise their value in operation.[71] Respondent R5 mentioned the importance of a quality educational system, whereby the better the educational base, the easier it is to find skilled people to absorb the technology.[72] Another respondent stated the relevance of having the right technicians involved on both sides of the project, and the recipient having a well-defined use case.[73] However, in the defence sector, skill requirements can be a niche expertise and focused on high-technology sectors. The development of these skills requires large amounts of capital investment, which sometimes cannot be made at the firm level, subsequently requiring state support. Additionally, a strong firm retention policy is crucial to hold the most valuable staff from competitors.[74]

Respondents also raised knowledge sharing as an important determinant for TAC. It is argued that successful TOT will depend on the level of knowledge that is shared and transferred across personal, departmental, and organisational levels, and how well this is understood by personnel at different levels and sectors of the organisation.[75] The concept is to encourage individuals within an organisation to exchange ideas and share their intellectual capital and work-related experiences, to then create new knowledge.[76] The TOT process can be lengthy, which requires institutional memory in addition to knowledge management. This means there must be a continuous process of local learning and interaction within and without the organisation to enhance knowledge transfer effectiveness. Real-world contexts and practitioner delivery is vital as it creates opportunities for relationships to develop.[77] Another respondent mentioned that the technology recipient should have a high-level of academic experience and user-knowledge to understand complex designs.[78]

The next important determinant involves culture. The local cultural context and the related work culture is often a significant determinant in influencing TAC.[79] These features include practices, beliefs, assumptions, principles, legends, and norms that affect how personnel think, make decisions, carry out tasks and embrace change within an

organisation. Culture also plays a big role beyond the local cultural context, in that defence culture can be idiosyncratic, based on precision, hierarchy, and timelines as well as a strong adherence to rules, regulations, and emphasis on the quality of products and processes. The work culture also determines commitment, interaction, loyalty, decision-making, and performance in the organisation.[80] Often, a strong positive work culture, such as the presence of social cohesion and teamwork, is associated with high organisational performance.[81,82]

A few scholars have developed a rationale for a strong relationship between the communication capability of an organisation with TAC, and its associated TOT performance.[83] One respondent mentioned that "it all starts with communication."[84] Sound communication will lead both parties towards a more accurate analysis of the buyer's current capability, what capability is needed (the buyer's need), and what capability can be provided by the seller.

It has been shown that there is a strong link between marketing and innovation, and subsequent development of new products[85] where there is a continuing need to find an equilibrium between market-pull and technology-push. Local technology recipients who want to be able to enhance their competitiveness should ensure that marketing and business development exists as a central function.[86] The marketing function can be used for sales, but can also be used to connect with customers to develop a feedback loop for new products or processes.[87] In most technology firms, there exists a subtle tension between the technology and marketing department as to whose role is more critical. The key is to find a client or customer-based solution in developing a product or service.[88,89]

Another key determinant for TAC is business acumen and continuity. In defence, the number of players is limited, and it is much harder to sustain business as overheads, operational costs, and entry and exit costs are much higher, all in a highly controlled environment.[90] Hence, it is important to ensure that existing players are supported, with continuity of policy. At the same time, TAC also requires technology recipients to invest into resources. The recipients must have a sound business plan for exploiting the new technology which involves an understanding of the size/availability of both local and international markets, the path to market, and the economics of the investments (future profit streams, future values of investments and income).[91]

Other determinants include a robust management process that involves having in place specific structures such as project management, financial management, IPR protection, and quality assurance, all of which will assure technology donors that they are working with a strong and reliable local partner. Technology receiving firms are required to have internal processes which are innovative and advanced. Infrastructure must also be set-up to absorb technology that meet the OEMs compliance standards. Further, there must be an emphasis on health and safety for quality purposes.[92,93] One respondent stated, "it is the people, but also the process, which is important to make the TOT to happen".[94]

Knowledge and skills of international acquisition and collaboration stakeholders

Considering that most TOT for defence firms form an integral component of defence acquisition, there is heavy involvement from policy-makers, capability planning

departments, government research organisations, and technology acquisition and offsets officials. These personnel will largely be engaged in the overall discussion with suppliers and their governments in identifying, negotiating, and acquiring the equipment, services, and related technologies.[95] These personnel need to be well-trained and equipped with the right level of skills and exposure to negotiate effectively and support recipient local firms in the TOT process. An organisation must have the requisite resources to fully exploit the benefits of acquiring a new technology.[96,97]

What are the challenges to successful TAC in SEA?

Unrealistic government aspirations and objectives

In the context of SEA, most respondents described a disconnect between government policy aspirations and objectives, and real industrial capability as well as the firm level of TAC in the nation. National governments sometimes have unrealistic expectations. Respondent R2 mentioned that Country X requested a contract from a large OEM to create employment in the aerospace industry, despite not having a sufficiently high technology aircraft industry to absorb the work package.[98] Respondent R1 quoted the example of Turkey and ROK as two nations with clear strategies and a high technology industry able to absorb new technology that should be emulated by SEA nations.[99]

The lack of stakeholder engagement

Close engagement is necessary when dealing with complex international acquisition projects and collaboration that involves multiple stakeholders. Often, weapons procurement is carried out by different services of the armed forces (end-users). The military officers are tasked to evaluate only the product in line within their capability requirement for defence of the realm.[100] The end-users are not responsible for issues related to the national economy, nor retention of defence industrial and technological capabilities in-country. One military respondent from Country X in SEA mentioned that even if the end-users do think of the economy or technological benefits, they are likely to be accused of facilitating an unfair procurement decision or playing favouritism. One respondent mentioned that they "do not blame (…) the armed service because if I was one of them, I would not deal with technology transfer too since there were no domestic laws for me to implement."[101] This means to say that government policies do not mandate the armed forces as the end-users to be responsible for technology transfer. Therefore, a nation should be clear as to who takes responsibility in ensuring technology transfer during international defence acquisition to build TAC. Questions nations must seriously consider include:

- Which organisation within the government, or armed forces, should be responsible for this task?
- How and when should industry be involved in the capability planning and acquisition processes?
- How should research organisations and academic institutions be incorporated into this process?

Lack of infrastructure and management processes within the buyer nation firm

Most respondents mentioned that technology recipient companies often do not have the pre-requisites for TOT, such as sufficiently advanced levels of required internal processes such as programme management, quality management, financial processing, and risk management. Respondent R1 revealed that during his audit exercise to one of the largest aerospace companies, one that was selected for TOT, his team assumed that the company would be supported by the offsets authority to complete an accepted project based on offsets policy.[102] There was an expectation that the company would have the infrastructure required to absorb the technology as it was the largest aerospace firm in the respective country and was part of a government-funded company.[103] However, he was shocked to realise that OEM-compliant infrastructure and processes to absorb the new technology were non-existent, or still done manually. Although the company had competent technicians, engineers, and other relevant personnel, it did not have the processes and standards required for safe and low-risk TOT.[104] Another respondent questioned the quality of production by host nations due to a lack of TAC. Respondent R2 quoted a case in where the in-country produced item lacked basic quality standards.[105] The OEM then had to source for other contractors and award the contract again, thereby incurring additional costs. There can also be a lack of adherence to process, increased risks and lower awareness of health and safety, especially in less industrialised countries.[106]

Poor relationship and contract management

Other issues include poor relationship and contract management. In TOT cases that involve technology donors and recipients, misunderstandings can arise over the scope, delivery, and mechanism of transfer. Buyers expect suppliers to guide them step-by-step in the TOT process, developing their skills and capability. However, suppliers are of the view that the door is open for the local firms to ask what they want, learn from observations, and absorb what they can to then develop their own capability.[107] This is in effect saying, "request the knowledge that you require." Respondent R19 cited a specific project that became messy as the buyer firm was unable to deliver, driving the supplier to set up eventually their own maintenance centre and bring in their own people to maintain the aircraft.[108] The buyer felt that the supplier was insincere, did not meet expectations, and provided low-quality contracts and processes. At the same time, one respondent suggested that sometimes obligors also offer projects of less value and little outcome.[109] One former industry supplier claimed that organisations sometimes covet technology and risk becoming technology ethnocentric if recipients do not have the capability to develop key technologies. But there are examples where such fears have been allayed, as TOT into industries in Western Europe and East Asia have been largely successful.[110] Similarly, protectionist laws and regulations being imposed by supplier governments can create barriers to TOT.[111] For example, the International Traffic in Arms Regulations (ITAR) are very restrictive and do not promote internationalism of contractor sales. To the contrary, respondent quoted that ROK's export laws are quite different. They are designed to promote exports and international collaboration.[112]

Lack of business and industrial knowledge

The lack of acquisition and business knowledge within acquisition officials can also be a major hindrance to enhancing TAC. In one case, challenges related to TOT due to local TAC processes were communicated to the relevant acquisition and offsets officials for the project. The supplier also offered to remedy these deficiencies. However, the acquisition officials were not concerned by the lack of local industrial in-company processes; nor willing to accept an alternate project to improve the company and allow the TOT to be completed.[113] This highlights the importance of acquisition and offset authorities' knowledge in the business activities, technical work processes, and quality processes that are required for approved projects.[114,115] Another respondent claimed that people in procurement do not have the knowledge and level of competency to negotiate successfully TOT, or are not sufficiently competent in the subject matter.[116] These officials were more interested in the technology being transferred itself, but failed to grasp the importance of having the necessary infrastructure in place for accomplishing successful TOT. In this case, the authorities themselves did not have the vision, nor competency, to understand what was required.[117] As many of the officials in these positions exist on a rotational basis, when they are transferred or promoted, organisations are not able to retain or capture the institutional memories. Retraining takes time and the knowledge is not readily available in the meantime.[118] Another issue is the silo mindset within government, which has created very narrow capabilities.[119] Often, recipients of the technology do not understand the basic concepts and processes of TOT. They may also lack understanding of the path towards commercialisation, as well as on issues of IPR.

Issue of cost for building TAC

Another important consideration which is often neglected in the case of TAC in the defence sector is around costs. In most cases, recipient firms prefer to hire foreign workers with existing knowledge due to cost issues and an unwillingness to invest in local human capital development.[120] However, projects with pure government funding may not be commercially driven. For example, a JV project in Country X was highly dependent on the continuity of its offsets business to get new orders. The local partner was not willing to invest into enhancing its own infrastructure, management, or skills capabilities, and was living off offsets contracts. The question was also whether there was a strong business case for economies of scale and high impact. In such cases, the internal commitment for organic development of TAC is not guaranteed as there is a lack of motivation.[121,122]

Thus, the question arises as to where the responsibility falls for accepting the costs of such activities. Who will pay for the costs of developing the TAC of firms, especially if they are state-owned entities?[123] Some countries that want to build genuinely the capability of their indigenous firms may find a way, through loans or profit-sharing agreements, to put in place the necessary infrastructure. Others may not see this as a state role. The local firm concerned may not want to risk investing due to the long lead time on returns of investment for defence-related businesses. Further, the investment in such technologies will be very costly. If there are no further orders, or business continuity, the firm may end up risking a large investment with no guaranteed returns.

Hence, there is a continuous tension between the state, the local firm, and the OEM on who will invest, how much to invest, and the relative sizes of investment responsibility for each party. This results in a further gap in local firms' TAC towards TOT success.[124,125,126]

Identification of local partners

Another challenge for suppliers in the TOT process is in finding a reliable local partner who has the right level of synergy and capability for technology absorption.[127] The question is how to identify such companies who are also effective and efficient.[128] For example, in some instances the local partner receives gold-plated contracts and are not motivated, thus threatening the commercial position of the TOT and the security of the business.[129] The issue is also that in some environments, private sector firms are much leaner and operate at a higher level of efficiency and performance compared to government-owned companies. Further challenges arise in finding appropriate parties to filter and identify suitable local partners. Another challenge lies in whether the government can steer and enforce the willingness to work between partners, or whether this should be left to the market, as in other sectors. There is also the issue of undertaking due diligence and filtering through potential technology recipients as the TOT is related to highly sensitive defence and dual-use technologies. Proactive action should be taken to provide a vetted list of technology recipients at the bilateral defence level or to the suppliers directly.[130,131,132,133]

Security of technology to enhance TAC

In the modern defence environment, many technology transfers require electronic communication between buyers and suppliers, their countries, and other stakeholders. This requires a robust IT infrastructure with a secured link and robust cyber protection to ensure that the technology being transferred to the local firm is not hacked, intercepted, or corrupted. There is already a huge concern that most technology recipient firms are underinvesting into IT infrastructure that can sufficiently protect against cyber threats and IPR theft. Once again, the responsibility for shouldering this cost is fiercely contested.[134,135,136]

OEM commitment to transfer technology to boost local TAC

Respondent R3 mentioned that one of the major frustrations for technology recipients is not being able to engage at the right level with the key people involved in the TOT process.[137] There can be differing levels of commitment and attitude between middle and lower rank technology negotiators who pitch for sales purposes and sweeteners, as opposed to those at higher levels within the organisation who may see TOT as a necessary evil.[138,139] The issue is that often negotiation is done at the highest level between businesses and the government; with politicians, or end-users, potentially being driven by different motivations. Hence, the TOT pledge risks seeming insincere and superficial.[140,141] On the part of the OEM, the lack of motivation, or genuine interest for TOT, is associated with the fear of developing competitors.[142] Hence, the argument is

that there is very little actual TOT that takes place in any permanent sense. In such cases where there exists an absence of trust, the buyers try and justify their act of reverse engineering, or process of unpacking the foreign technology and putting it back together again. This action is viewed as unethical by suppliers and reduces the extent to which suppliers can control the transfer process and increase flow of know-how. Overall, this mistrust results in a poor buyer-supplier relationship which in turn can lead to failure of the strategic partnership, preventing successful TOT from taking place.[143]

Lack of technical skill and knowledge in technology recipients

One of the other challenges relates to the level of experience and skill of workers within technology recipient firms to evaluate the level of technology being transferred and to identify existing technological gaps and the capabilities required to absorb that new technology. Some personnel lack an understanding of technical language, nor can appreciate lean processes. In some countries with lower levels of TAC, most manufacturing companies do not even have basic manufacturing processes, let alone lean processes, which can make automation hard.[144] It is still challenging to dive into digitisation.[145,146,147] One respondent referenced an incident during a recent supply chain request for a proposal by foreign companies, where the manufacturing companies in the buyer nation provided a quote 100–300% higher than estimated. The lack of experience and competitiveness makes these companies less attractive for OEMs.[148] It is often too expensive to hire an expert consultant who can provide independent advice.[149] In some more advanced countries, external subject-matter experts with good track records and high levels of integrity are used for such work. These are some clear examples of how recipient firms can struggle with securing work packages due to a lack of TAC.

Conclusion and policy suggestions

It is a challenging process for suppliers to facilitate technology transfer during international defence acquisition, whilst also ensuring the enhancement of TAC. There is constant political and economic tension at the state, industry, and firm level. The emphasis of TAC is primarily to aid in building defence capability, while the secondary objective is for economic growth. State-to-state bilateral engagement is crucial in ensuring that TAC is enhanced. Hence, in this paper we conclude that increasing levels of TAC and the level of technology transfer commitments depends on strong and trustworthy relationships at the national level; the existence of a robust defence industrial and technology strategy; and a clear technology roadmap supported by technology depository databases which capture national technology requirements. Further, a reliable technology donor-recipient relationship, especially a genuine commitment from the supplier, must be emphasised and demonstrated.

The essence of successful TOT and enhancement of TAC will depend on the level of commitment between technology donor and recipient. Even above technical requirements, it is this trust and felt commitment that will ensure a successful relationship. Nonetheless, the low success rate reflects the many challenges involved. This paper has also identified and discussed some of these challenges at length. These include allegations that defence acquisition and offsets authorities set unrealistic goals and aspirations in

their expectations of TOT. Further, a lack of engagement between stakeholders, end-users, research organisations and industry in aligning TAC requirements can hinder growth. Other challenges include a lack of business acumen, poor relationships between buyers and suppliers, as well as a lack of technical skills, poor infrastructure, poor contract management and poor management processes within technology recipient organisations, and a lack of knowledge in acquisition officials.

Finally, to ensure successful TAC, the international defence acquisition and collaboration community could further deliberate on the following suggestions. First, the need to consider decoupling acquisition from industrial collaboration activities. This entails the involvement of local defence industries at the outset of the capability planning stage, and not much later at the final stages of acquisition, as is often the case. Second, it is also important to consider defence procurement in a holistic manner, from a macroeconomic perspective in terms of how defence can also generate economic value. There is an increasing overlap between defence and commercial technologies, especially in the dual-use space. Hence, as the civil–military integration space becomes more pertinent, it will be useful to explore how defence acquisition and offsets can offer opportunities for recipients to absorb technologies in areas such as cyber, artificial intelligence, and advanced digital technologies. Third, suppliers and technology donors could consider moving their advanced manufacturing, or research facilities, to buyer nations if there are economies of scale or a real business case. In such instances, buyer nations can create an attractive investment environment for the TOT to occur. This can occur through creating exclusive economic zones for low tax, low rent, favourable IPR conditions, removing trade barriers and providing beneficial trade incentives. Fouth, buyers and suppliers should also aim to get rid of middlemen, develop good governance, and promote anti-corruption compliances in the international defence acquisition and collaboration environment. Buyer governments must create a trustworthy and safe environment for businesses and the TOT to take place, such as by enforcing anti-corruption and Cyber-security law. Governments and firms must invest in human capital and competencies. This could look like researchers and engineers being given opportunities through attachments, exchange programmes, and higher education to gain sufficient knowledge and exposure to be able to absorb new technologies. Finally, international defence acquisition and collaboration training and education must be made an essential component of executive development, as well as implementing continuous education for all officials and stakeholders involved in this sector. Achieving the recommendations in this paper for enhancing TAC could transform the global defence acquisition market but more specifically for SEA nations.

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Disclosure statement

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

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