MILITARY TECHNOLOGY AND ADVANCEMENT

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In accordance with Bitzinger's (2015) classification of a nation's defence sector, Malaysia can be categorised as a "third-tier" arms producer because its defence sector is only able to produce relatively "low tech" small arms, ammunition, armoured vehicles, and small ships, including small arms licenced production like rifles, as well as assembling imported parts for specific military equipment like helicopters. Japan, Indonesia, Singapore, South Korea, and Taiwan are examples of "second tier" nations with advanced indigenous defence industries that can design, develop, and produce their own weapons systems (Bitzinger, 2015). The 'first tier' nations, including the United States, the United Kingdom, France, and Germany, have the capability and know-how to domestically create their own weapon systems (Balakrishnan & Matthews, 2009). Malaysia has been investing in military technology and advancement since its independence in 1957. Over the years, the country has developed and acquired various types of military equipment and systems, including armored vehicles, aircraft, naval vessels, and weapons. The MAF is responsible for the country's defence and is divided into three branches: the Malaysian Army, the Royal Malaysian Navy, and the Royal Malaysian Air Force. Each branch has its own unique set of requirements for military equipment and systems, and the country has pursued a mix of indigenous development and foreign acquisition to meet these needs. One of the earliest examples of Malaysia's indigenous development of military technology is the construction of the Malaysian-made GAF Nomad light transport aircraft in the 1970s.

In recent years, the country has since gone on to develop other indigenous systems, such as the AV8 Gempita armored fighting vehicle and the MD Helicopters MD 530G light

attack helicopter. In terms of foreign acquisitions, Malaysia has purchased a range of military equipment and systems from countries such as the United States, Russia, and France. One of the most notable asset is the Sukhoi Su-30MKM fighter aircraft, which is considered to be one of the most advanced fighter jets in the region. Malaysia has also made efforts to develop its defence industry, with the establishment of various government agencies and initiatives to promote the growth of the sector. These include the Malaysian Industry-Government Group for High Technology (MIGHT), the National Aerospace Industry Coordinating Office (NAICO), and the Malaysian Defence Industry Council (MDIC). However, there has been a gap in research for Malaysia's military industry's development since its inception in the aerospace sector in 1976. Malaysia's military technology and advancement have been shaped by a mix of indigenous development and foreign acquisition, as well as efforts to develop the country's defence industry. Thus, the country continues to invest in new technologies and systems to enhance its defence capabilities and to address regional security challenges.

According to Balakrishnan (2008), Malaysia's defence industry was founded in 1976 with the aerospace sector in an aircraft repair and overhaul facility. Since then, it has expanded into other sectors including weaponry, information and communication technology (ICT), automotive, aerospace, and marine. Its development is closely linked to the military hardware purchases undertaken by the Malaysian Armed Forces (MAF) as part of its strategic development plan, known as the Fourth Dimension Malaysian Armed Forces Strategic Plan (4D MAF) (Daud, 2017). The MAF spent a large portion of its efforts controlling the communist insurgent threat before to 1989, and it was the first nation to do it. After the 1990s, the nation's economy grew, giving the government the resources to purchase more advanced weapon platforms and expand the duties and responsibilities of the navy and air force to better complement those of the army.

The vision 2020 objectives set out by the then-most honourable prime minister Dr. Mahathir Mohamad helped to advance the development of Malaysia's military sector landscape. Through this vision, technological transfers and offset initiatives were implemented in the purchases of defensive equipment from other nations (Balakrishnan & Matthews, 2009). Presumably, this was done while keeping in mind the country's constraints in terms of its capabilities and capacity to build technologically sophisticated weapon platforms. It also serves to advance the nation's defence self-sufficiency (Balakrishnan & Matthews, 2009; Bitzinger, 2015).

Before the Asian Financial Crisis in 1997 and following 1989, the nation witnessed unheard-of economic development, which aided in bolstering the government's initiative to invest in education. As a consequence, a larger portion of its population received the training and information required, which has helped the nation's military sector to expand. The Global Economy, 2019) and the increase in university enrolment, which went from 3.82% in 1979 to 44.12% in 2016 (The Global Economy, 2019), provide a straightforward means of verifying the claims. In Malaysia, the literacy rate in 1991 was approximately 83%, and by 2010, it had increased to approximately 93%.

Military technology and advancement refer to the use of scientific and engineering knowledge, techniques, and equipment for military purposes, with the aim of improving military capabilities, effectiveness, and efficiency. It encompasses a wide range of areas, including weapons systems, vehicles, aircraft, communications, surveillance and reconnaissance, cybersecurity, and logistics. Military technology and advancement involve the development, acquisition, and deployment of new and advanced technologies and

systems, as well as the improvement of existing ones. It is driven by the need to keep up with evolving threats and challenges, and to maintain a military edge over potential adversaries. Military technology and advancement are critical components of national defence and security, as they enable military forces to operate more effectively and efficiently, and to project power and influence over a wider range of territories. Malaysia's military technology and advancement can be categorized into several areas such as weapons, vehicles, aircraft, and naval vessels.

Here are some examples of current Malaysia's military technology and advancement in approaching Malaysian Armed Forces capabilities through indigenous research and development, acquiring advanced technologies, upgrading existing technologies, collaborating with industry and investing in cybersecurity. As the Malaysian Army upgrades its armoured vehicles and armament through the procurement of new tanks and artillery systems, Malaysia has been spending in research and development to develop its own military technology. Additionally, Malaysia has been creating its own military technologies, such as the domestically made armoured combat vehicle known as the AV8 Gempita. The AV8 Gempita armoured vehicle, an 8x8 wheeled armoured personnel carrier, was created in Malaysia. It is utilised by the Malaysian Army and is furnished with a 40 mm automatic grenade launcher, a 12.7 mm machine gun, and a 30 mm cannon. An indigenous armoured combat vehicle called the AV8 Gempita was created by the Malaysian defence sector in partnership with the Turkish defence firm FNSS Savunma Sistemleri (Roslan et al., 2018). The AV8 programme, which was started in 2000 with the goal of creating a cutting-edge armoured vehicle to replace the deteriorating fleet of armoured personnel carriers and infantry combat vehicles in the Malaysian Armed Forces, was responsible for the creation of the vehicle. The AV8 Gempita is an extremely adaptable 8x8 wheeled armoured vehicle that

can be modified for a variety of purposes, including command and control vehicle, armoured personnel carrier, and infantry fighting. It has a three-person crew and has a capacity of 12 fully outfitted soldiers.

Additionally, it has cutting-edge weaponry, such as a 30mm cannon, a 12.7mm machine gun, and a 7.62 mm machine gun. Additionally, it includes cutting-edge communications and sensing systems as well as modular armour protection that is adaptable to individual missions' unique needs (Malarvizhi et al., 2021). The AV8 Gempita's creation was a significant turning point for Malaysia's defence sector, showcasing the nation's capacity to create cutting-edge military technologies. The creation of jobs, as well as chances for technology transfer and information exchange, came about as a result of the development of the AV8 Gempita, which had substantial economic advantages for Malaysia. With this strategy, Malaysia can produce technologies that are customised to its unique requirements and lessen its dependency on imported technology.

In addition, Malaysia has been obtaining cutting-edge military technology from other nations to improve its capabilities. Sukhoi Su-30MKM fighter planes, for instance, are used by Malaysia and include cutting-edge electronics and weaponry. The Royal Malaysian Air Force uses the Sukhoi Su-30MKM multirole fighter jet, which has cutting-edge avionics and weaponry systems, including air-to-air and air-to-surface missiles. A multirole fighter aircraft called the Sukhoi Su-30MKM was created by the Russian aircraft company Sukhoi in association with the Malaysian aerospace sector. The aircraft is an improved version of the Su-30, equipped with cutting-edge avionics, weapons systems, and other improvements made specifically for the Royal Malaysian Air Force (RMAF). As part of its attempts to modernise and enhance its military capabilities, Malaysia purchased the Su-30MKM. In order for

Malaysia to build its own competence in the upkeep, repair, and upgrading of the aircraft, the acquisition required a sizable transfer of technology and information between Russia and Malaysia. In addition to creating jobs and opening up prospects for knowledge transfer for the local aerospace sector, Malaysia's procurement of the Su-30MKM had substantial economic advantages. The Malaysian government used the acquisition to support domestic technological advancement and to lure international capital into the nation's aerospace industry. Malaysia's air defence capabilities have been greatly improved by the Su-30MKM, a very proficient fighter aircraft. Its advanced avionics, weapons systems, and other features make it a formidable platform for air-to-air and air-to-ground missions, and its ability to operate in a wide range of environments and weather conditions makes it a valuable asset for Malaysia's defence.

On the other hand, Malaysia has been modernising its current military technology to increase the lifespan and capabilities of such systems. For instance, the Royal Malaysian Air Force has installed updated avionics and weaponry in its F/A-18D Hornet fighter aircraft. The Royal Malaysian Air Force (RMAF) launched the F/A-18D Hornet Upgrade Programme (HUP) to update and improve the capabilities of its current fleet of F/A-18D Hornets (Ismail, 2019). The HUP sought to improve a number of F/A-18D Hornet components so they would remain applicable and successful in situations of contemporary combat. The programme was designed to specifically modernise radar systems, electronic warfare capabilities, the integration of new weaponry, targeting systems, and communication.

Malaysia has also been working with business to create and acquire military technology. For instance, Malaysia and France agreed to work together to create a Gowind-class frigate with cutting-edge weaponry. A line of modular, multi-mission frigates known as

the Gowind-class was developed and produced by the French shipbuilding firm Naval Group (formerly DCNS). According to Sullivan (2014), the frigate is made to be extremely flexible and capable of carrying out a variety of tasks, including anti-air, anti-surface, and anti-submarine warfare. A frigate of the Gowind class weighs 2,500 tonnes and is 102 metres in length. It has cutting-edge weaponry, including torpedo launchers, anti-ship missiles, and surface-to-air missiles. Advanced radar and electronic warfare equipment are also on board the ship. It is well suited for a variety of tasks because it is built to function in both blue water and littoral conditions. It is also made to be easily adjustable to fit the unique needs of various fleets.

Two Gowind-class frigates, KD Maharaja Lela and KD Hang Tuah, are operated by the Royal Malaysian Navy. These frigates were created to improve the anti-air and anti-surface warfare capabilities of the Royal Malaysian Navy. They have cutting-edge sensors and weaponry, including a 76 mm main cannon, anti-ship missiles, and surface-to-air missiles. They also have sophisticated electronic and radar warfare equipment. Malaysia also possesses a number of navy ships, such as the Lekiu-class frigate and the offshore patrol ship of the Kedah class. The Lekiu-class frigate is outfitted with anti-ship missiles and torpedoes, while the Kedah-class ship is armed with a 76 mm gun.

Last but not least, the MAF also determined to enhance their skill in network security with collaboration with Malaysian Communications and Multimedia Commission (MCMC) and has recognized the importance of cybersecurity in modern warfare. Therefore, they has been investing in its cybersecurity capabilities. For example, the Malaysian government established the Malaysia Computer Emergency Response Team (MyCERT) in 2019, with the aim to monitor and respond to cybersecurity threats towards strengthening the country's

cybersecurity posture. The Malaysia Computer Emergency Response Team (MyCERT) is a specialized agency under the MCMC that is responsible for handling cybersecurity incidents in Malaysia. MyCERT was established in 1997 to serve as a central agency for coordinating responses to cybersecurity incidents, providing technical assistance, and promoting cybersecurity awareness in Malaysia (Nor et al, 2018). MyCERT's main objective is to enhance the security and resilience of Malaysia's critical information infrastructure, including government networks, financial systems, and other key sectors of the economy. MyCERT works closely with other government agencies, industry partners, and international organizations to monitor and respond to cybersecurity threats, and to provide training and technical assistance to organizations and individuals to help them improve their cybersecurity posture. MyCERT provides a range of services, including incident response, vulnerability assessments, penetration testing, and cybersecurity training and awareness programs. It also maintains a database of cybersecurity threats and vulnerabilities, which is used to inform its responses to incidents and to provide guidance to other organizations on how to protect themselves from cyber threats.

However, Malaysia’s military technology also have significant economic and industrial implications, as the development and production of military technology often involves significant investment and innovation, and can drive technological progress in civilian sectors as well. Military innovation and technology are intricately linked to different facets of society, politics, economics, and international relations. The following are some illustrations of the numerous connections between military technology and advancement: Political connections Political ties between countries and military development are strongly related. For instance, the creation and use of cutting-edge military technology by one nation may influence the security considerations and strategic planning of other nations, resulting in arms races, deterrence, and alliances. The direction and financing of military technology

development can also be influenced by political decisions and agendas. Military innovation and technology have a huge impact on the economy since they need investments in R&D, manufacturing, and procurement. The military-industrial complex is a web of government organisations that deals with defence.

In addition to that, Malaysia's reputation has been improved in conjunction with developed nations through the most important national events, such as LIMA (Langkawi International Maritime and Aerospace Exhibition) and DSA (Defence Services Asia). LIMA and DSA are two of Malaysia's biggest defence and security shows, and they both have a significant impact on the development of military technology in Malaysia. Both LIMA and DSA offer a forum for the sharing of information, suggestions, and best practises in the military and security industries, as well as a showcase for the most recent international defence and security technology and goods. The exhibitions also offer opportunities for networking, partnership building, and technology transfer, which can benefit Malaysia's military technology and advancement in several ways of promotion, collaboration and advancement (Klyuchanskaya, 2011).

In the access to advanced technologies, LIMA and DSA provide Malaysia with access to the latest defence and security technologies and products from around the world. This allows the country to acquire advanced equipment and systems that can enhance its military capabilities. Besides, these events also promote the knowledge transfer and technology sharing as it facilitate knowledge transfer and technology sharing between Malaysia and other countries, including industry experts, scientists, and engineers. Thus, it can help Malaysia to develop its own expertise in the design, development, and manufacture of advanced defence and security technologies which allow the promote the development of Malaysia's defence

and security industries, by providing opportunities for local companies to showcase and network their products and technologies to global industries (Chandran, 2014). In the order hand, LIMA and DSA serve as a platform for collaboration and partnership building between Malaysia and other countries, allowing the country to work with international partners to develop joint research and development projects, exchange ideas and expertise, and jointly address regional security challenges.

However, there is some challenges arise from every aspects in advancing and developing the technologies such as financial, limitation and retention. The constraint in budget is absolutely been the main issue like many countries. As Malaysia's defence budget is limited, thus it may be difficult to fund the development and acquisition of advanced military technologies and systems. Besides, the technology gaps also play a significant importance in limitation of technology advancement. While Malaysia has made significant progress in developing its own indigenous military technologies, there are still gaps in its capabilities, particularly in areas such as cybersecurity, artificial intelligence, and autonomous systems. Malaysia still needs to upgrade their capabilities to improve the best system that remains well-secured of national defence. Moreover, Malaysia also still lack in self-reliance which its dependence to foreign countries in technology and logistics advancement. Malaysia still depends on foreign suppliers for many of its military technologies and systems, which can limit its ability to control the development and production of these systems, as well as expose it to potential geopolitical risks.

In conclusion, Malaysia has advanced its military technology and capabilities significantly by addressing a variety of approaches to the development of defence technology. The modernization of current technology and the development of new, cutting-

edge technologies in the military will not only improve the defence and security of the nation but will also have a favourable impact on the MAF's operational capabilities. With these measures, the Malaysian government might strategically plan to rebuild and reorganise the defence and security sectors to make them more pertinent to the requirements of the nation in the future. Although Malaysia has improved its military technology and capabilities, it is vital to remember that military modernization is a continuous process, and the nation still needs to deal with financial limitations and other challenges. The extent of Malaysia's military advancement can also be influenced by geopolitical factors, national priorities, and strategic considerations. However, Malaysia's commitment to modernizing its military and enhancing its capabilities demonstrates its efforts to stay relevant in a rapidly evolving security landscape.

The recommendation of the Malaysia’s technology and advancement can be several ways to improve such as strengthening the cybersecurity. In today's interconnected world, cybersecurity threats are increasingly sophisticated and prevalent. Malaysia could invest further in its cybersecurity capabilities to safeguard against cyber threats and protect its critical infrastructure. As the world becomes increasingly developed, cybersecurity will become even more critical for the defence of Malaysia's national security among countries. Next, the country can increase R&D investment as Malaysia is likely to continue to invest in growing its defence industry, with the aim of reducing its dependence on foreign suppliers and developing its own indigenous capabilities. Thus, Malaysia could increase its investment in research and development to develop new military technologies and capabilities which lead to the development of new technologies and the creation of new jobs in the sector improve its self-reliance on foreign technologies.

Besides, Malaysia also can improve by enhancing training and education by play a crucial role in the readiness and effectiveness of the military. Malaysia could invest in advanced training facilities and programs to enhance the skills of its military personnel and prepare them for modern threats. Last but not least, the country can improve the logistics and support. The military relies heavily on logistics and support systems to maintain its readiness and effectiveness. Malaysia could focus on improving its logistics and support systems to ensure that its military is well-equipped and well-supported in the field. Lastly, strengthening the cooperation and alliances can play a key role to the technology advancement which Malaysia could strengthen its defence cooperation and alliances with other countries to leverage their military capabilities and expertise. This could help Malaysia to improve its interoperability with other militaries and enhance its regional influence. Malaysia has established collaborations with various foreign partners, including the United States, Russia, and France. These partnerships could lead to the acquisition of new technologies and the transfer of knowledge, which could further enhance Malaysia's military technologies and advancement.

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