

**ENHANCING INNOVATION THROUGH RESEARCH AND DEVELOPMENT:
TOWARDS THE SUSTAINABILITY OF THE MALAYSIAN DEFENCE INDUSTRY**

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ABSTRACT

Malaysia's Defence Policy and Defence White Paper strongly advocate for the development of the Malaysian defence science, technology and industrial capability to meet the national 'self-reliance' objective and for the long-term sustainability of the Malaysian Armed Forces. Yet, currently, there is an increasing debate within the Malaysian defence sector fraternity that government R&D allocation and investment into the defence industry sector have not yielded sufficient benefits and innovation. Furthermore, there is no existing Research and Development and Innovation model that can be applied by the Malaysian Defence Industry (MDI). This leads to a modest scale of success in Malaysia's defence and dual-use innovation despite continuous investment into R&D. Most of the MDI stakeholders point to insufficient defence R&D allocations and funding as the main reasons for the lack of innovation. Evidence shows that defence R&D spending through the annual defence budget increased gradually from 2005 to 2020 but there is a lack of parallel evidence of how the increasing defence R&D funding has enhanced innovation within the MDI, leading to increased profits, revenue, and exports. In this context, literature suggests that elements such as strategic focus, resource commitment and collaborative engagement between the stakeholders are essential in effectively managing government defence R&D allocation for defence industrial innovation to happen. This is an exploratory-based applied research, underpinned by pragmatism philosophy that uses a case study methodology. The research employs multi-method qualitative research to describe and analyse the rarely studied defence R&D phenomenon within the context of the MDI. Data is collected from secondary and primary data sources, namely reviews of literature and documents, questionnaires and in-depth interviews. The data were analysed using the thematic approach and further triangulated for reliability and validity. The research findings suggest considerable challenges in terms of defence R&D in MDI are due to low level of strategic focus, limited guidance and weak implementation; weak collaboration; and resource commitment that exists but limited in funding reflecting the disconnect between what is being practised in the MDI and what is stated in the theories of research, development and innovation (R&D&I) as critical success factors for implementation of R&D programs. The thesis proposes the Malaysian Integrated Defence R&D&I Framework which is a collaborative framework that explains the stakeholders' roles and detailed implementation protocol to enhance innovation through defence R&D in the MDI as a pathway to successful industrial innovation.

ABSTRAK

Dasar Pertahanan Malaysia dan Kertas Putih Pertahanan menganjurkan pembangunan sains dan teknologi pertahanan serta keupayaan industri bagi memenuhi objektif keupayaan berdikari ke arah kelestarian Angkatan Tentera Malaysia. Walaubagaimanapun, pada masa kini sektor industri pertahanan semakin rancak mendebatkan mengenai peruntukan dan pelaburan Kerajaan dalam penyelidikan dan pembangunan pertahanan yang tidak menghasilkan faedah dan inovasi yang setimpal. Tambahan pula, ketiadaan satu model Penyelidikan dan Pembangunan dan Inovasi yang boleh digunapakai oleh Industri Pertahanan Malaysia pada masa kini menyebabkan skala kejayaan yang sederhana dalam pertahanan dan guna-sama pertahanan Malaysia, disebalik pelaburan berterusan dalam R&D. Majoriti pemegang taruh industri pertahanan menyatakan peruntukan dan bajet yang tidak mencukupi merupakan punca utama kekurangan inovasi dan seterusnya mempengaruhi pertumbuhan industri. Bukti menunjukkan perbelanjaan R&D pertahanan melalui peruntukan tahunan pertahanan meningkat secara beransur-ansur sejak 2005 hingga 2020, namun terdapat kekurangan bukti selari tentang bagaimana peningkatan pembiayaan R&D pertahanan telah meningkatkan inovasi dalam Industri Pertahanan Malaysia yang membawa kepada peningkatan keuntungan, hasil dan eksport. Dapatan literatur mencadangkan tumpuan strategik pada pembangunan R&D pertahanan, komitmen terhadap sumber dan penglibatan kolaboratif antara pihak berkepentingan adalah elemen penting dalam mengurus R&D pertahanan dengan berkesan ke arah inovasi pengindustrian. Tesis penerokaan berasaskan penyelidikan gunaan ini adalah disokong oleh falsafah pragmatisme yang menggunakan metodologi kajian kes menerusi penyelidikan kualitatif pelbagai kaedah untuk menghuraikan dan menganalisis fenomena R&D pertahanan yang jarang dikaji dalam konteks Industri Pertahanan Malaysia. Perkara ini dilaksanakan melalui pelbagai pengumpulan data daripada pelbagai sumber data, termasuk sumber data sekunder, iaitu ulasan literatur dan dokumen; dan sumber data primer, menggunakan tinjauan, termasuk soal selidik dan temu bual mendalam. Data yang diperolehi kemudiannya dianalisis menerusi pendekatan secara tematik dan kemudian menerusi kaedah *triangulation* bagi kebolehpercayaan dan kesahan. Penemuan penyelidikan mencadangkan MDI masih menghadapi cabaran besar dari segi R&D pertahanan disebabkan tahap fokus strategik yang rendah, bimbingan terhad dan pelaksanaan yang lemah; kolaboratif yang lemah; dan komitmen sumber yang wujud tetapi terhad dalam pembiayaan yang mencerminkan terputusnya hubungan antara apa yang diamalkan dalam MDI dan apa yang dinyatakan dalam teori penyelidikan, pembangunan dan inovasi (R&D&I) sebagai faktor kejayaan kritikal untuk pelaksanaan program R&D. Dalam konteks ini, tesis ini mencadangkan Rangka Kerja R&D&I Pertahanan Bersepadu Malaysia yang merupakan rangka kerja kerjasama yang menerangkan peranan pihak berkepentingan serta protokol pelaksanaan terperinci untuk meningkatkan inovasi melalui R&D pertahanan dalam MDI ke arah kejayaan inovasi industri.

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APPROVAL

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LIST OF ABBREVIATIONS

DESIB	Defence, Enforcement and Security Blueprint
DID	Defence Industry Division
DWP	Defence White Paper
ICP	Industrial Collaboration Program
MAF	Malaysian Armed Forces
MDI	Malaysian Defence Industry
MIDES	Malaysian Industry Council for Defence, Enforcement and Security
MINDEF	Ministry of Defence, Malaysia
NDUM	National Defence University of Malaysia
STRIDE	Science and Technology Research Institute for Defence

CHAPTER 1

INTRODUCTION

1.0 Background

Investment into defence R&D has been a contentious but equally important subject for nations. There is not only a continuous debate over the allocation of national resources between defence and non-defence sectors but also between defence and non-defence R&D. Policymakers and academics often raise the question of opportunity costs of investing taxpayer's money into defence R&D as opposed to commercial R&D (Lichtenberg, 1995; Ghoshroy, 2011). Let alone the challenges to ring fence budget allocation for defence R&D, it is even harder to justify significant defence R&D budget allocation for small developing nations such as Malaysia. However, there are many arguments for why continuous government investment into defence R&D is important. These arguments are often based on the proposition that defence R&D had created some of the most significant innovations which have spilled over to the civil sector and vice-versa.

It is argued that government R&D investment is the main catalyst for the armed forces to acquire new capabilities in responding to the ever-changing security landscape and to ensure defence effectiveness by equipping countries with

sophisticated military technologies to safeguard and maintain technological superiority over potential adversaries (Dunne, 2018; Valiathan, 2016; Jacobsen, 2015; Okur, 2013; Bellais, 2012; Mowery, 2012; Jermalavicius, 2009; and Peled, 2001). Defence R&D is also claimed to have led to innovation in technology that drove to change in defence performance, national productivity and wealth creation (Bellais, 2012; Mowery, 2012; Jermalavicius, 2009; and Peled, 2001). National defence R&D policies are also aimed at building in-country capability and human capital that can innovate and contribute to industrial and economic growth associated to innovation. For example, in the era of post Second World War, major western nations invested heavily in defence R&D through collaborative government research think-tanks and the defence industry sectors. Prime motivation was to design, develop and own critical technologies directed toward building some level of in-country capability or self-sufficiency in supporting national armed and military capability (Dunne, 2018; Valiathan, 2016; Okur, 2013).

Nonetheless, defence R&D is not without its costs. Issues of opportunity cost and its effectiveness compared to civilian R&D have been highlighted (Hartley, 2006 in Jermalavicius, 2012; Lichtenberg, 1995;). Defence R&D is identified as risky and uncertain (Mowery, 2012). In addition, defence R&D overemphasis on technology leads to underestimation of the many low-tech means and ways by which adversaries could asymmetrically respond to one country's technological supremacy have also been described in the literature (Bellais, 2012; Ghosroy, 2011).

Extensive studies and reports have been established in the area of defence R&D. However, these studies have been primarily focused on trends and technology

requirements and capabilities of defence R&D (Deloitte Development LLC, 2020; Bellais, 2012; Mowery, 2012) or research on nations that have huge spending on defence R&D (Dunne, 2018; Pfothenauer et al., 2016; Valiathan, 2016; Okur, 2013; Jermalavicius, 2009). It can be said that there had been other work produced on defence R&D, but they are not many especially for or on small nations.

The defence industry sector is a key stakeholder that benefits from government R&D funding for innovation. The defence industry sector has seen a boom-and-bust growth cycle since the end of the Cold War as shown on Figure 1.1.

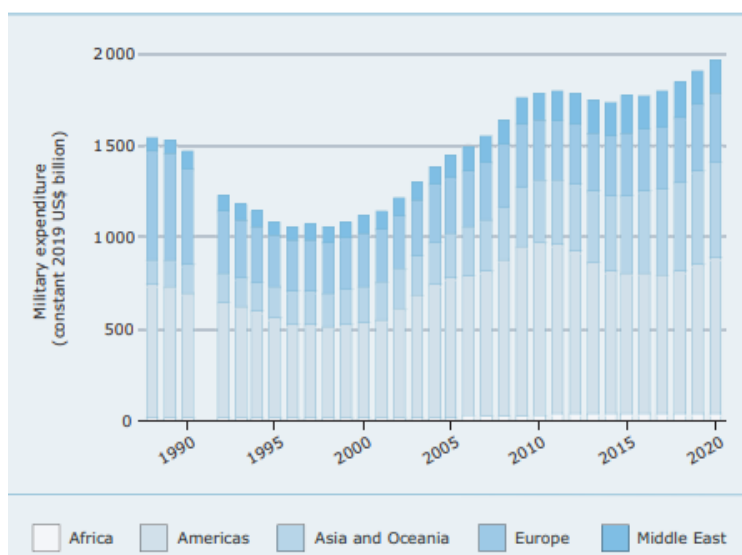


Figure 1. 1 : World Military Expenditure, by region, 1988–2020 (SIPRI)

However, the defence industry sector witnessed a growth trajectory between 2018 to 2020 on the back of defence spending made by governments around the globe that continue to modernise and recapitalise their militaries. In December 2019, SIPRI (2019) reported that the sales of arms and military services by the sector’s largest 100 companies (excluding those in China) totalled \$420 billion in 2018, marking an

increase of 4.6 per cent compared with the previous year and an increase of 47 percent since 2002 (the year from which comparable data is first available) (SIPRI, 2019). It was reported that defence expenditure was expected to grow about 2.8%, crossing the \$2 trillion mark in 2021 (Deloitte Development LLC, 2020). The defence industry growth were contributed by intensified security threats in the continuously uncertain and complex international security environment worldwide, primarily led by the United States and other countries such as China, France, India, Japan, the Middle East, and the UK (Deloitte, 2019). SIPRI lists the top 100 defence and security companies in the world with companies like Lockheed Martin, Boeing, Northrop Grumman, Raytheon and General Dynamics topping the list (SIPRI, 2019). This increase in budget allocations and sales reflects the industry's prowess and resilience, despite facing the ups and downs of global economic changes.

Despite the increased allocation for defence, overall allocation to defence R&D in actuality continued to decrease since the early 1950s, with the commercial sector taking the lead in R&D (Sargent Jr. et al., 2021; Brzoska, 2006). The argument made on this phenomenon is related to a paradigm shift from military culture of technology generation towards military use of technologies driven by civilian R&D, particularly in electronics. The main reason for this trend has been the growth of industry-funded R&D, focused on commercial sector and the decline of share in public funding for defence R&D, which led to decreased importance of military R&D (Sargent Jr. et al., 2021; Brzoska, 2006).

This policy shift from defence to civil R&D for generation of innovation (Sargent Jr. et al., 2021; Brzoska, 2006) raises an interesting observation and the need

for the global defence sector to review the relevance and importance of defence research and its contribution to innovation. The need for such review is increasingly critical as most newer technological breakthroughs and innovation are in the dual-use space. At the same time, this review is also related to the difficult task of any nation that owns a defence industrial and research base in allocating available scarce resources towards the expensive effort in maintaining technological advancement, while facing issues such as reduced government expenditures on R&D and the need to think innovatively in terms of being cost-effective, and at the same time coming up with latest innovations.

In the context of this research, Malaysia, located in the Southeast Asia region, has attempted to develop a defence industrial and research base since 1970s. There is a dedicated defence R&D institution known as the Science Technology Research Institute of Defence (STRIDE) that undertakes matters related to defence R&D for the Malaysian Armed Forces (MAF) (Ahmad, 2021; Wan Hanafi, 2021). However, the question is to what extent Malaysia has been successful in using government defence R&D allocation to spin-off innovation? And what has been the challenges and obstacles to attaining the intended results? The next section briefly contextualises the Malaysian defence R&D environment leading to the problem statement, research questions and objectives.

1.1 The Malaysian Defence Policy and Contextualising Self-Reliance

At the macro level, Malaysia's defence philosophy is aimed at achieving self-reliance. In this context, self-reliance is measured by the country's ability to defend its territorial

integrity and national sovereignty with minimal dependence on foreign assistance (MINDEF, 2020; Sathyamoorthy, 2010)¹.

The Malaysian Defence White Paper (DWP), which was approved in the Parliament in 2019 and subsequently published in 2020, mentions that “although Malaysia is not beset by military threats or conflicts at the present moment,” the goal of defence self-reliance is important to Malaysia as the country continues to face ever-increasing and uncertain defence related challenges in an uncertain environment, encompassing three main security challenges. The first challenge relates to uncertain big power relations, especially the ongoing tension between the U.S. and China; second, complex Southeast Asian neighbourhood such as maritime claims in the South China Sea; and third, increasing non-traditional security threats that come in many forms such as extremism, terrorism, and kidnapping for ransom. Facing these challenges and uncertainties amid stagnating budgetary requirements for Malaysian defence affect the MAF in renewing their assets and thus impacting their operation capability, which is a huge challenge (MINDEF, 2020).

These challenges confirm MINDEF’s and the MAF position that emphasises the National Defence Vision, which forms the basis of national defence interests, namely security; sovereignty; and prosperity (MINDEF, 2020). This realisation increases the rationale for self-reliance as an important and fundamental principle of defence and especially highlights the importance of advancing Malaysia’s defence industry as a catalyst in developing defence science, technology and industry through

¹ The Covid-19 pandemic proves the need for Malaysia to be self-reliant and not dependent on outside capabilities in many sectors including defence. In addition, the Lahad Datu intrusion in 2013 reminds Malaysia of the importance of defence self-reliance capabilities, of being perpetually ready and capable to defend our nation from unwanted intruders.